The American Journal of Surgery

EDITED BY THURSTON SCOTT WELTON, M.D.

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FIFTY-FIFTH YEAR OF CONTINUOUS PUBLICATION

February 1946

VOLUME LXXI NUMBER 2

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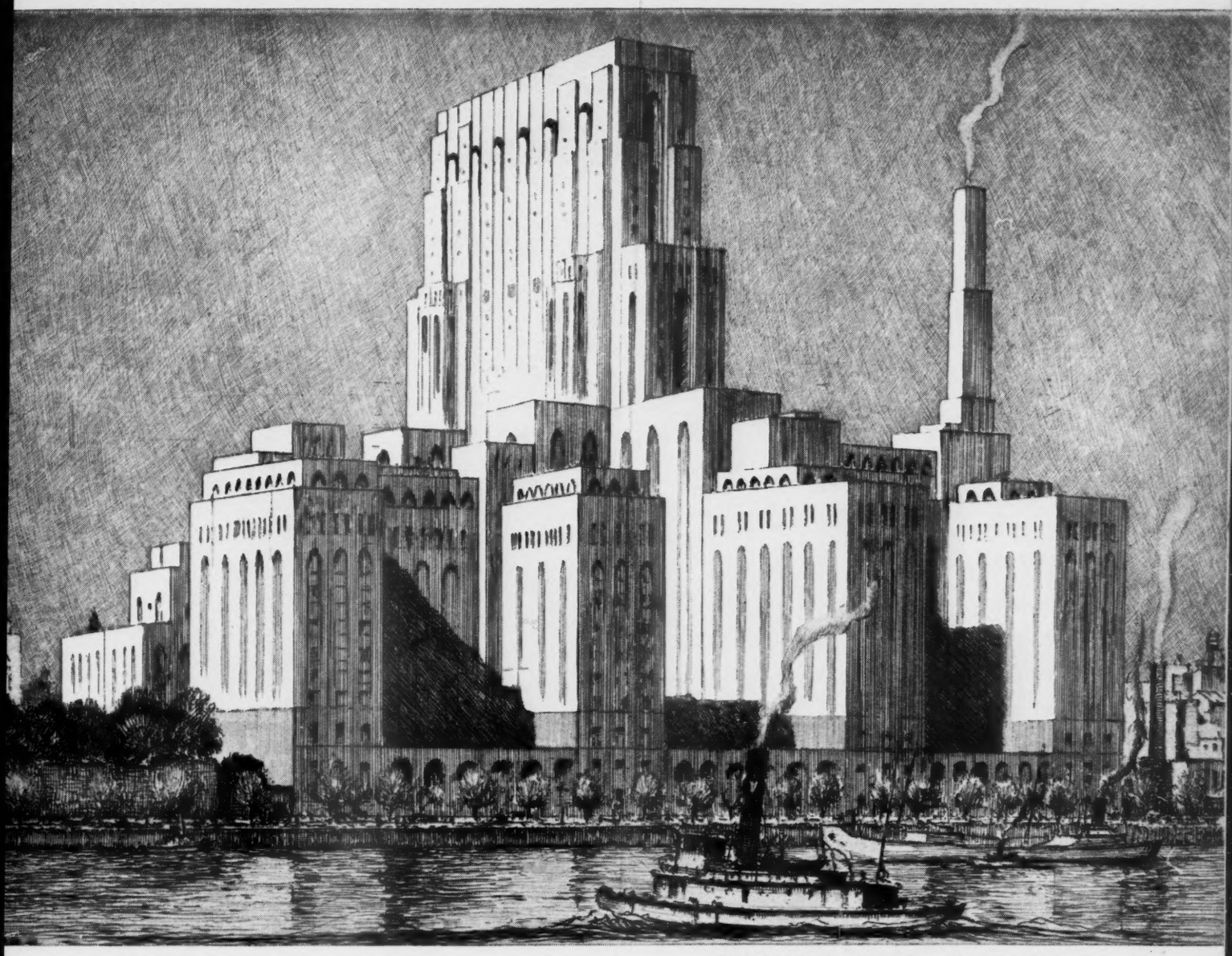

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Advances in surgical technique depend not only on increasingly efficient application of modern knowledge, but also on the constant acquisition of new information. Described and illustrated on the following pages is the last in the series of "Incisions That Minimize Wound Disruption." The complete series in booklet form will be made available shortly by D&G, and may be obtained on request.

Incisions that Minimize

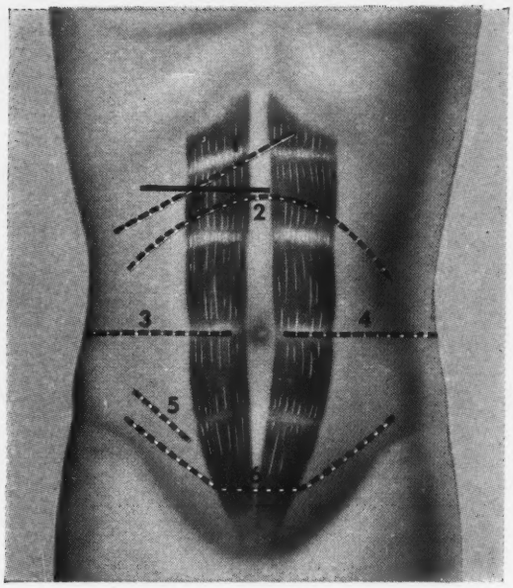
The employment of operative incisions which offer maximal assurance against sutures pulling through the tissues eliminates one of the principal causes of wound disruption and lessens the possibility of post-operative herniation.

Sutures hold most securely if the connective tissues within the wound are approximated in such a manner that the sutures must pull against the fibres within these layers. This necessitates cutting the connective tissues parallel to the direction of their fibres which, in the anterior abdominal wall, is usually best accomplished through a transverse initial skin incision.

In the past, transverse abdominal incisions have not found wide acceptance because they necessitate cutting across muscles in which sutures hold poorly and almost invariably cause tissue necrosis.

In the new technic of suturing transverse incisions, no attempt is made to suture muscle—only the surrounding sheath. Approximation of the muscle edges is further aided by keeping the patient in a semi-reclining position with knees partially flexed.

Because of the favorable results attending increasing use of this technic, and the current interest in principles which may facilitate early ambulation, D&G presents a series illustrating the incisions, and methods of suturing them.



1. For gall bladder, common duct, head of pancreas.
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4. Descending colon, spleen and left sided lesions.
5. Appendectomy.
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*7. Small exploratory transverse incision.

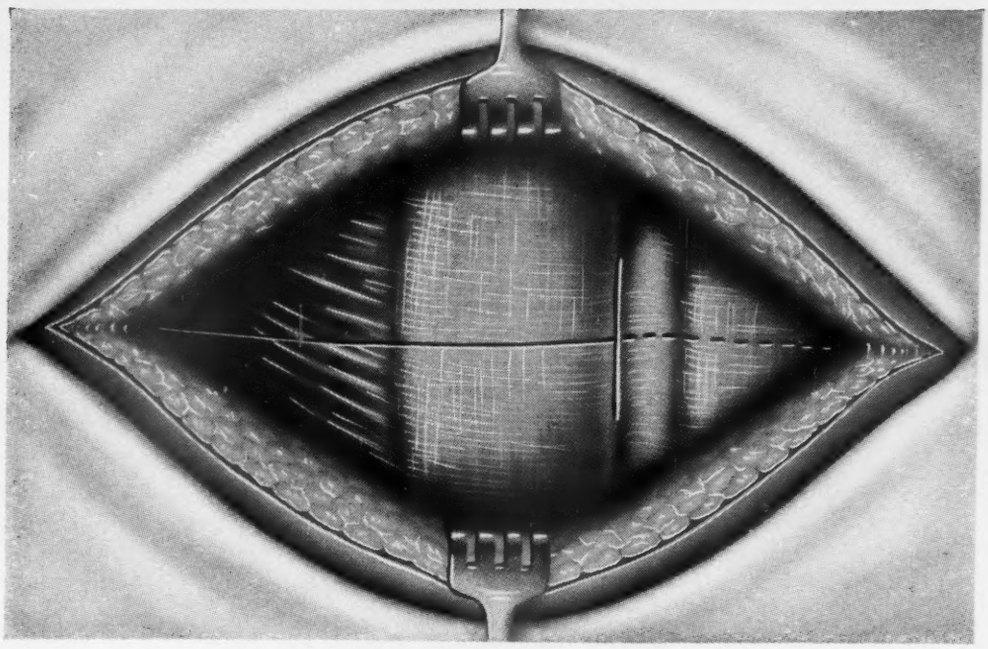
SMALL EXPLORATORY TRANSVERSE INCISION

THIS small transverse incision in the epigastrium is useful for suturing the perforated peptic ulcer or for taking a biopsy of the liver. The muscles are not cut and they return to their original position. Hence the patient can be ambulated on the day after operation without fear of wound disruption.

After the skin incision is made, the recti are moved laterally either on one or both sides. To do this the anterior rectus fascia is cut and the muscles are freed in their sheath by blunt dissection. They are retracted laterally by loop retractors. Further lateral

Wound Disruption

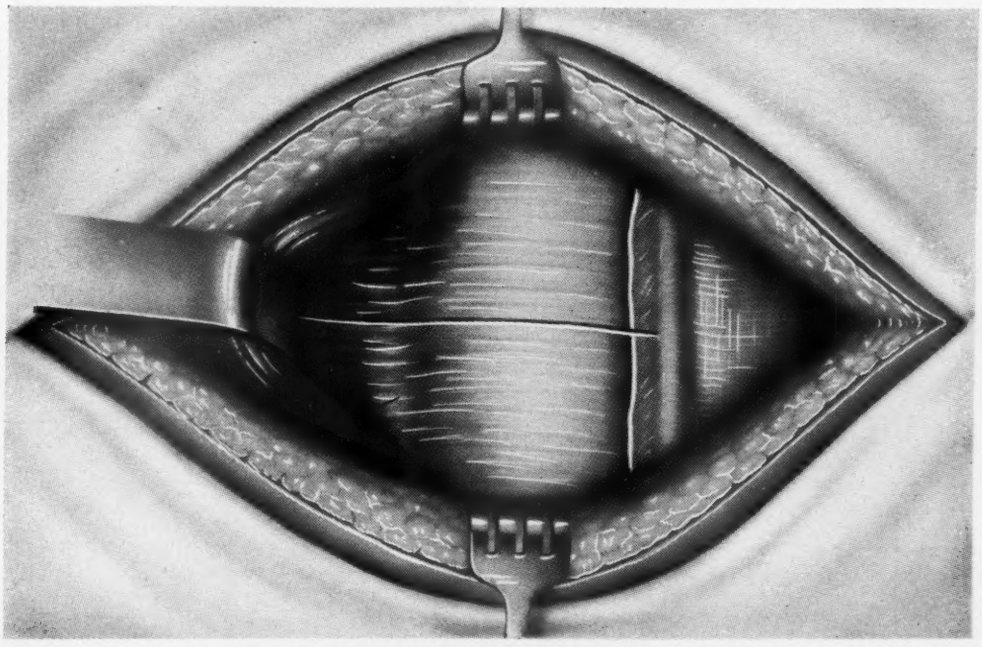
NUMBER SEVEN OF A SERIES



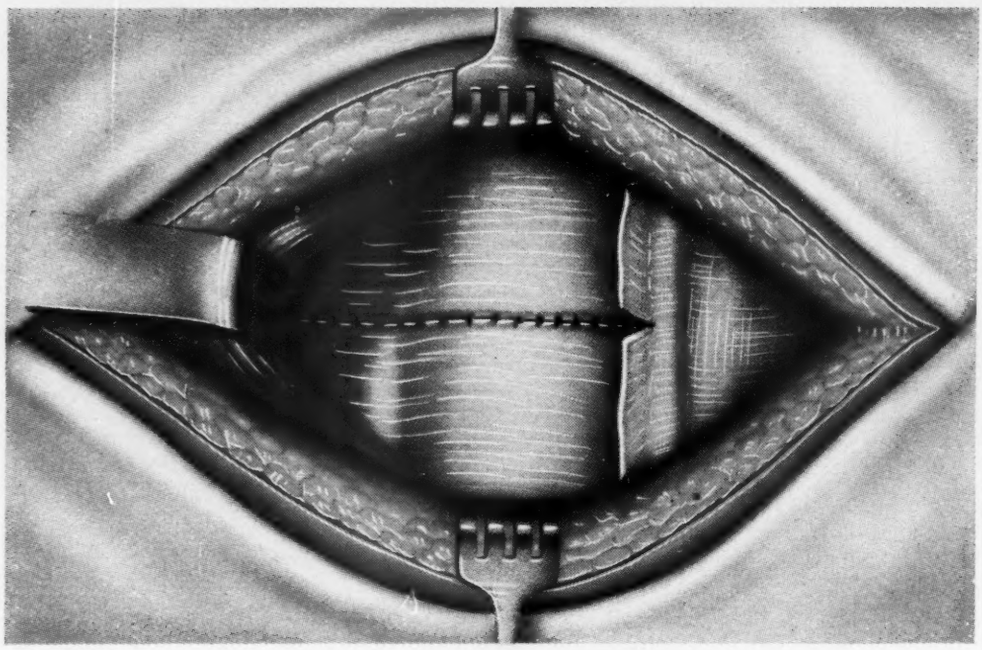
Incision in anterior rectus sheath. Longitudinal extension along medical border of rectus muscle.

mobilization of the muscle is obtained by incising the anterior rectus fascia cephalad near the midline. The procedure for doing this on the right side is shown. After the posterior rectus sheath and the peritoneum is divided the round ligament must be divided and ligated. If the exposure is not adequate, the incision can be converted into a complete transverse incision by cutting either or both recti.

Incision posterior rectus sheath muscle retracted laterally.

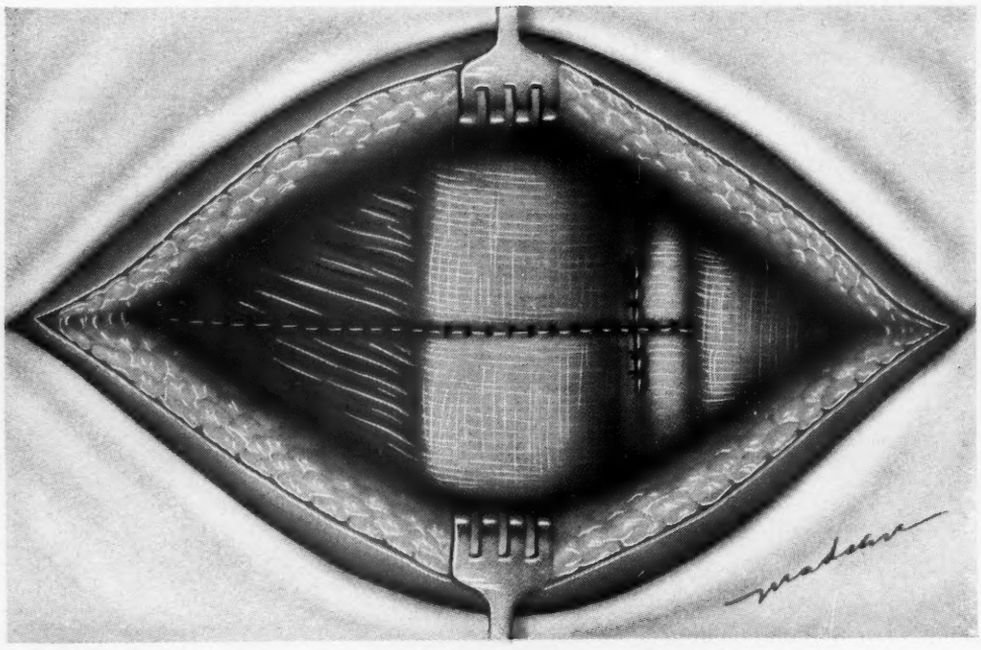


Incisions that Minimize Wound Disruption



Sutured posterior rectus sheath and peritoneum.

Interrupted sutures are placed only in the posterior and anterior sheaths. The muscles are not sutured in the midline although the cephalad extension in the anterior rectus sheath may require one or two sutures. The skin is closed in the usual manner. (*Reprints of this series may be obtained on request.*)



Sutured anterior rectus sheath.

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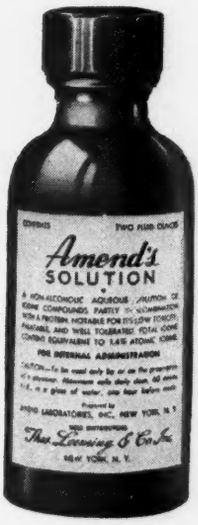

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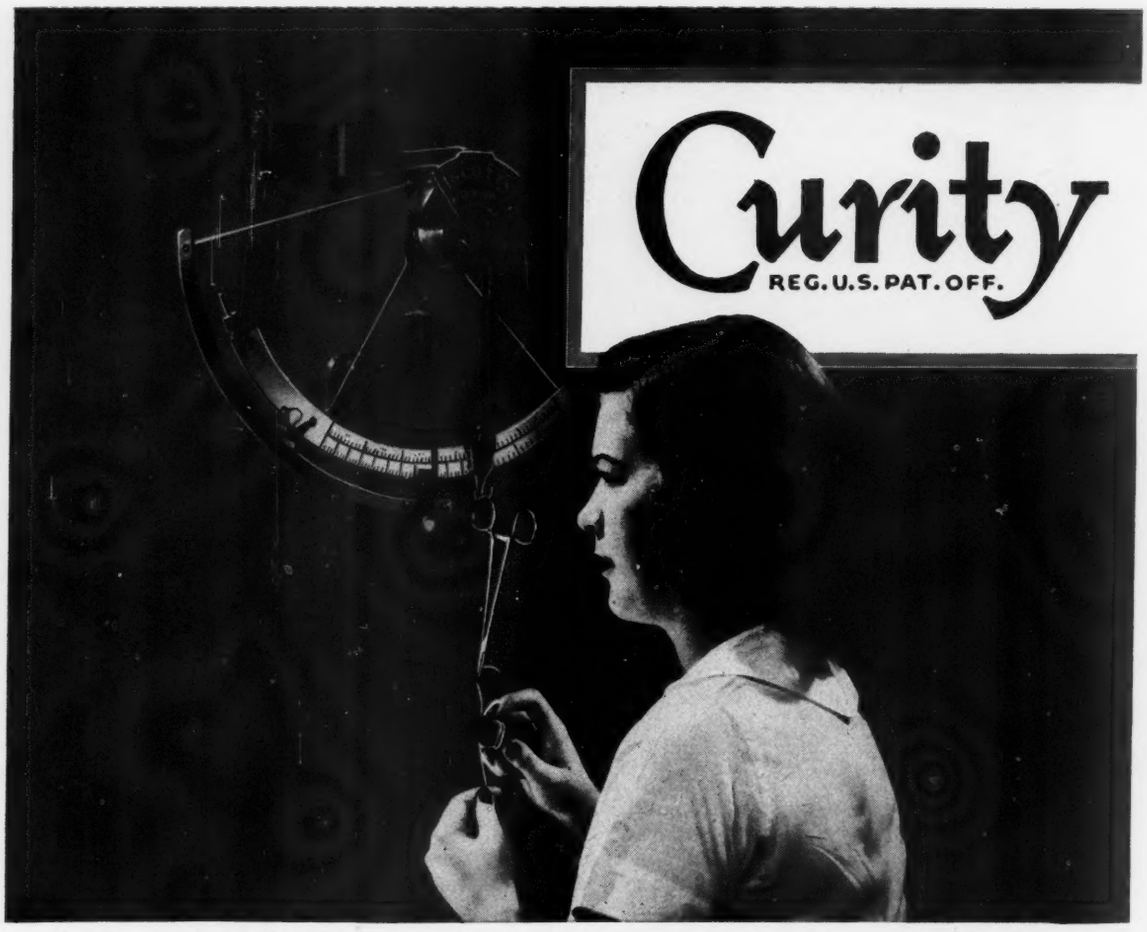

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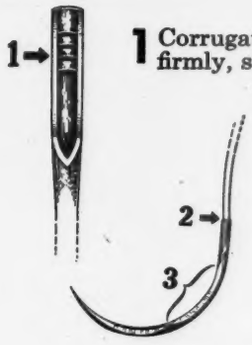

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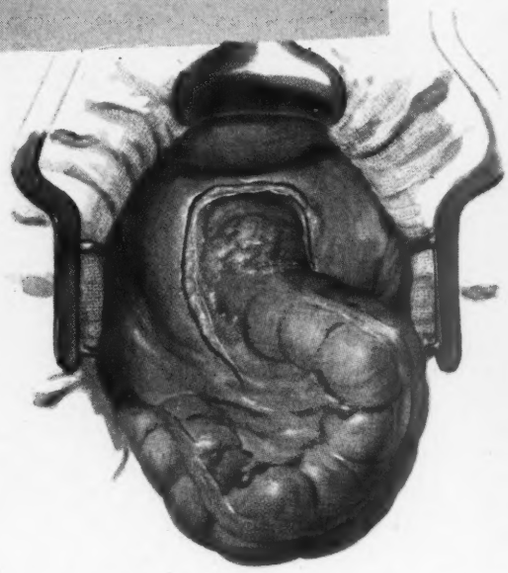
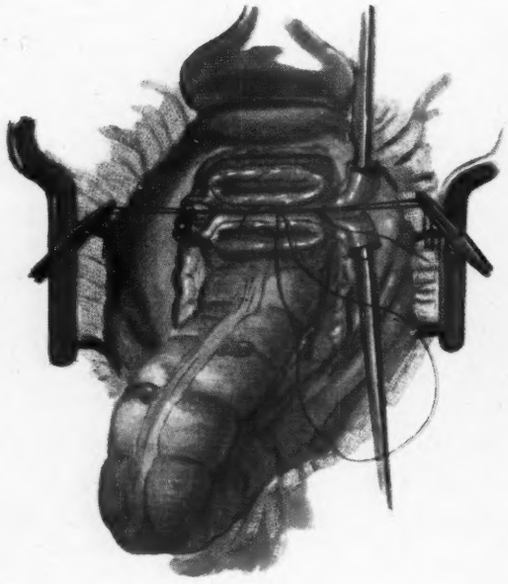
END TO END ANASTOMOSIS — PRESERVATION OF SPHINCTER

I: Carcinoma of upper rectum. Anterior resection indicated because lesion is too low for obstructive resection while it is high enough to permit anastomosis after excision.

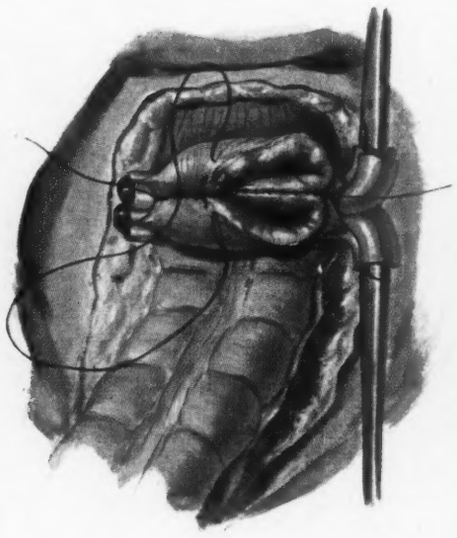


II: Abdominal approach through long mid-line suprapubic incision skirting left side of umbilicus.

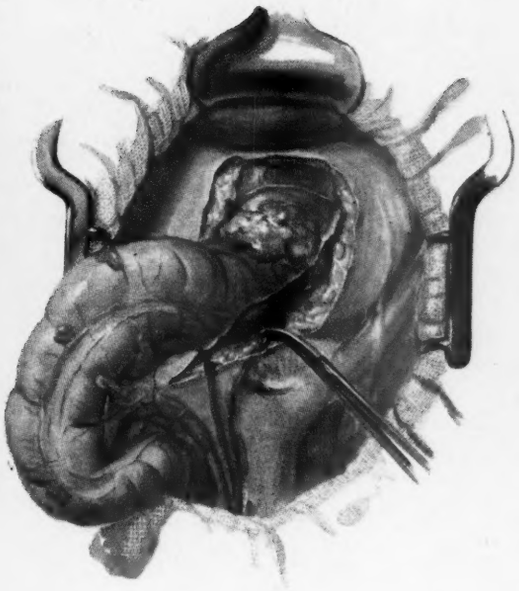
U-shaped incision of peritoneum in recto-vesical pouch and along either side of mesentery.



V: End to end anastomosis. After fixation sutures have been placed. Continuous Cushing suture for first posterior layer is shown.

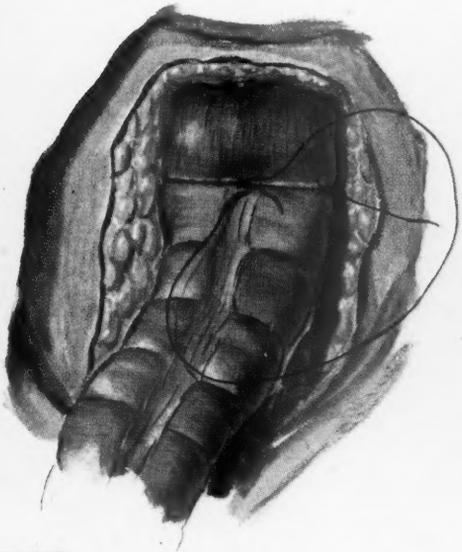


VI: Second posterior suture completed. It is being continued as the first anterior layer (an inverting Connell suture).

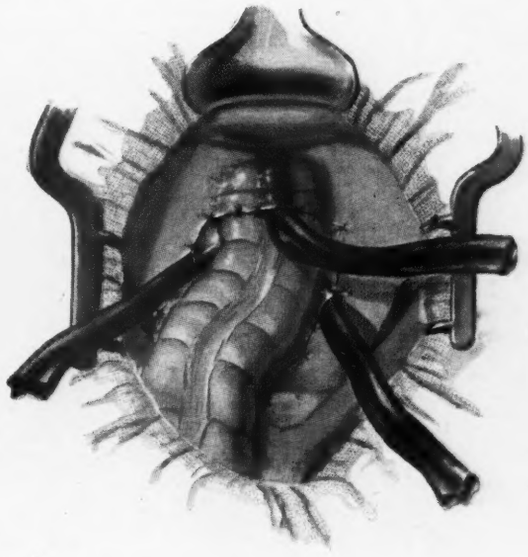


III: Mobilization with ligation of lower sigmoid and superior hemorrhoidal vessels. Middle and inferior hemorrhoidal vessels remain for blood supply of rectum.

IV: Bowel after mobilization doubly clamped and severed as indicated.



VII: Completion of suture anastomosis with anterior Cushing suture.



VIII: Peritoneum closed around bowel—with adequate drainage to the anastomosis.

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In tying a knot, the skilled hands of the surgeon recognize instantly when the "end point" has been reached. It is that point at which the knot is tied down firmly and completely—the point at which there is no further yield, the point of complete security. To achieve this end requires a suture of balanced physical properties—a suture which will not break before it reaches the perfect end point and which is not too rigid to "tie down" completely. Armour surgical gut is outstanding as a suture material of fine tying qualities. You may judge the qualities for yourself only by actual trial. A sample will be sent gladly to hospitals, physicians and surgeons upon request.

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Sutures and Ligatures

THE ARMOUR LABORATORIES
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Complete Accessibility

SPEEDS THE OPERATION . . .

The degree of pre-design study devoted to x-ray facilities is further emphasized by the freedom and ease with which lateral fluoroscopy of the femur and tibia is accomplished.

In such procedure, the foot section of the Table may be readily detached for reception of the operator between the patient's lower extremities. Lateral tilt of the Table with positioned x-ray head in corresponding lateral tilt, facilitates unobstructed fluoroscopic observations and more accurate end results.

The AMERICAN

ALBEE-COMPER FRACTURE TABLE

is unparalleled for true accessibility in fluoroscopic examinations and in the obtaining of permanent x-ray records of greater interpretive accuracy.

Structural advantages in both open and closed reduction and in orthopedic operations, include surgical operating and traction facilities as well. In all cases, this greater maneuverability and accessibility are time-conserving factors of importance.

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STRONG
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AIRE-LITE, made from fine flexible strands of Fiberglas and cellulose acetate, is a newly developed, clinically tested bandage for making light, waterproof casts. After being immersed in AIRE-LITE SETTING FLUID the bandage is wrapped on smoothly and allowed to dry. Dimensional stability and great strength in the finished cast are assured by the Fiberglas strands.

It is the ONLY cast

—that will admit light and air
—that is buoyant in water
—that is all plastic

AIRE-LITE bandage is the ONLY cast material that is elastic—that can be stretched as it is being applied—allowing for true conformation to the slightest deviation in contour.

It is suitable for the smallest finger cast or the largest double spica.

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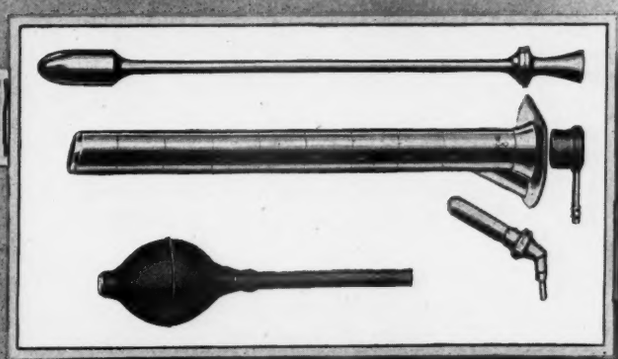
Yeomans'



Proctoscope.

The Yeomans' Proctoscope consists of a tube 10 inches long, with a working length of 8 inches graduated in eight one-inch divisions. Its distal end is slightly oblique, and the proximal end is fitted with a large flange having a milled edge. A small segment is cut from one side to prevent rolling. An auxiliary tube to accommodate a light carrier perforates the flange and joins the main tube at an angle.

Illumination is direct, and is obtained from a small powerful electric bulb covered with a capsule holding a plano-convex lens so set that the collected rays are refracted at a compensating angle to the light carrier. The light carrier fits accurately into the auxiliary tube by means of a conical fitting so that only the lens projects into the main tube. Therefore, all the rays are focused at the distal end. The vision of the observer, and the path for the introduction of the instruments for examination, local application or operation are always clear, there being no obstruction.

A lens cap closes the proximal end of the proctoscope tube and contains a glass window which magnifies the illuminated field at the distal end of the tube. Fastened to the side of this lens cap is a nipple which provides for the attachment of a hand bulb to inflate the bowel. The conical fittings of the lens cap and light carrier prevents the escape of air when pneumatic pressure is applied. The obturator has an olivary tip which facilitates the introduction of the tube. The tubes are made in various sizes:

Proctoscope Tube 10 inches long (8 inch working length), ¾ inch in diameter.
Proctoscope Tube 12 inches long (10 inch working length), ¾ inch in diameter.
Infant Proctoscope Tube 10 inches long (8 inch working length), ½ inch in diameter.
Sigmoidoscope Tube 14 inches long (12 inch working length), ¾ inch in diameter.

The same light carrier fits all the above tubes. In practice, it will be found that the most useful size which will fill the requirements in the majority of cases is the 10 inch by ⅞ inch tube. (8 inch working length).

The entire instrument may be carried in the physician's bag, and for this reason it is supplied without a case. All parts of the instrument which come in contact with the patient may be sterilized by boiling.

YEOMANS' PROCTOSCOPE

Yeomans' Proctoscope (Catalogue No. 293) complete with 10" x ⅞" tube and obturator, light carrier, conducting cord, lens cap, lamp and inflation bulb, without case, $35.00.

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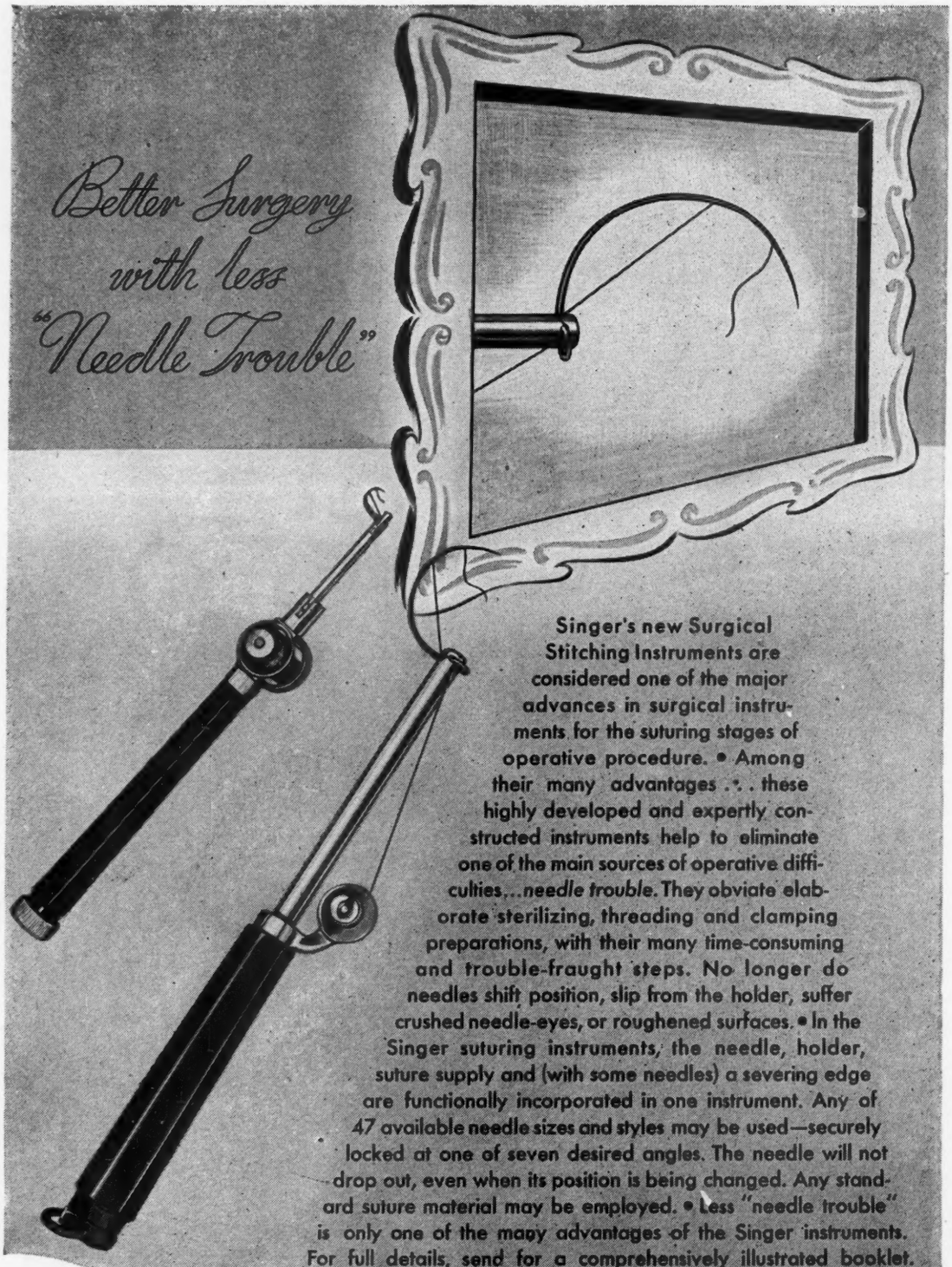

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SIR ISAAC NEWTON'S RESEARCH WORK in the late 17th century paved the way for the tremendous forward strides made in science in the 19th and 20th centuries. So too, in the field of Surgery . . . the research work of SKLAR'S metallurgists paved the way for one of the great forward steps in surgical instrument making . . . the discovery of the proper alloy of stainless steel for use in manufacturing surgical instruments.

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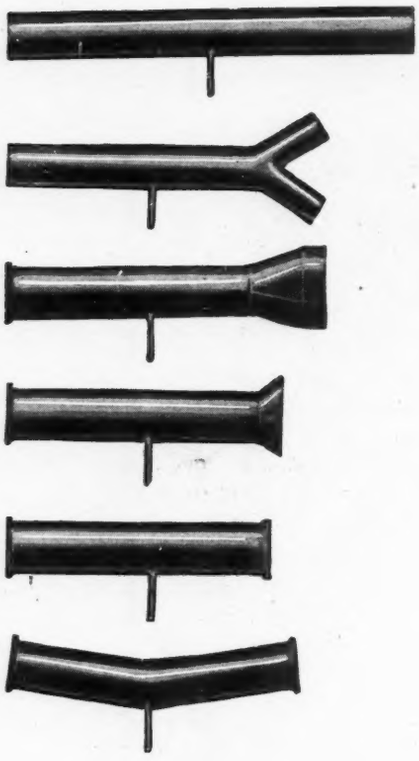

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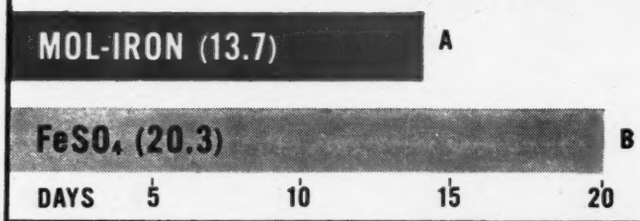
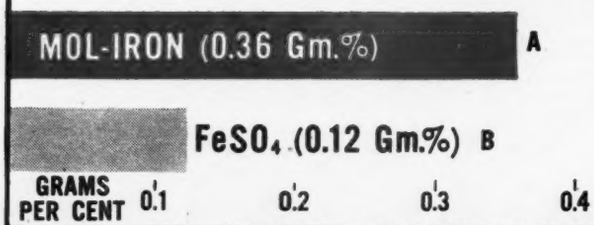
RAPIDITY OF CLINICAL RESPONSE (Days)



(A) Completely effective therapeutic response (return to normal blood values) was obtained in an average of 13.7 days of Mol-Iron therapy.

(B) Ferrous sulfate therapy *failed* to produce normal hemoglobin values after an average of 20.3 days.

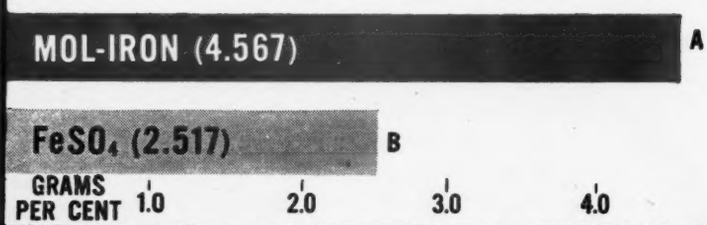
AVERAGE DAILY HEMOGLOBIN INCREASE (Gm. Per Cent)



(A) The group treated with Mol-Iron averaged a daily hemoglobin increase of 2.48 per cent (0.36 Gm. per cent).

(B) The group treated with ferrous sulfate showed an average daily gain of hemoglobin of 0.83 per cent (0.12 Gm. per cent)—a response about one-third as effective.

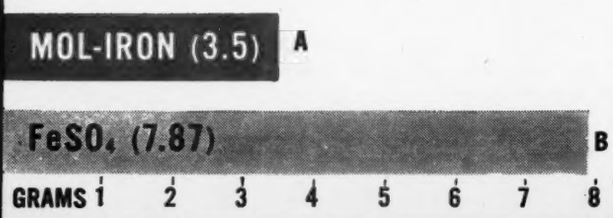
TOTAL HEMOGLOBIN INCREASE (Gm. Per Cent)



(A) The total hemoglobin increase (in an average of 13.7 days) averaged 31 per cent (4.56 Gm. per cent) in the Mol-Iron treated group.

(B) A mean gain of only 17 per cent (2.51 Gm. per cent) hemoglobin resulted in an average period of 20.3 days during which the ferrous sulfate treated group was observed.

THERAPEUTIC INTAKE OF BIVALENT IRON (Gm.)



(A) The Mol-Iron treated group received an average total of 3.528 Gms. of bivalent iron to produce the sought for result (return to normal blood values).

(B) While an average ingestion of 7.87 Gms. of bivalent iron failed to achieve an optimal response in the ferrous sulfate treated group.

The charts summarize the results of a controlled study of comparative therapeutic response in post-hemorrhagic and nutritional hypochromic anemias.

The series includes 49 cases treated with Mol-Iron and 21 with exsiccated ferrous sulfate; the results are typical of those observed in treatment of iron-deficiency anemias with White's Mol-Iron.

in Treating Iron-Deficiency Anemias

A specially processed, co-precipitated complex of molybdenum oxide (3 mg.) and ferrous sulfate (195 mg.).

White's MOL-IRON TABLETS

Available clinical evidence indicates that, in hypochromic anemia, the therapeutic response to this highly effective synergistic combination—as compared with equivalent dosage of ferrous sulfate alone—has unusual advantages:

1. NORMAL HEMOGLOBIN VALUES ARE RESTORED MORE RAPIDLY, INCREASES IN THE RATE OF HEMOGLOBIN FORMATION BEING AS GREAT AS 100% OR MORE IN PATIENTS STUDIED.
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3. GASTRO-INTESTINAL TOLERANCE IS NOTABLY SATISFACTORY—even among patients who have previously shown marked gastro-intestinal reactions following oral administration of other iron preparations.

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DOSAGE: One or two tablets three times daily after meals.

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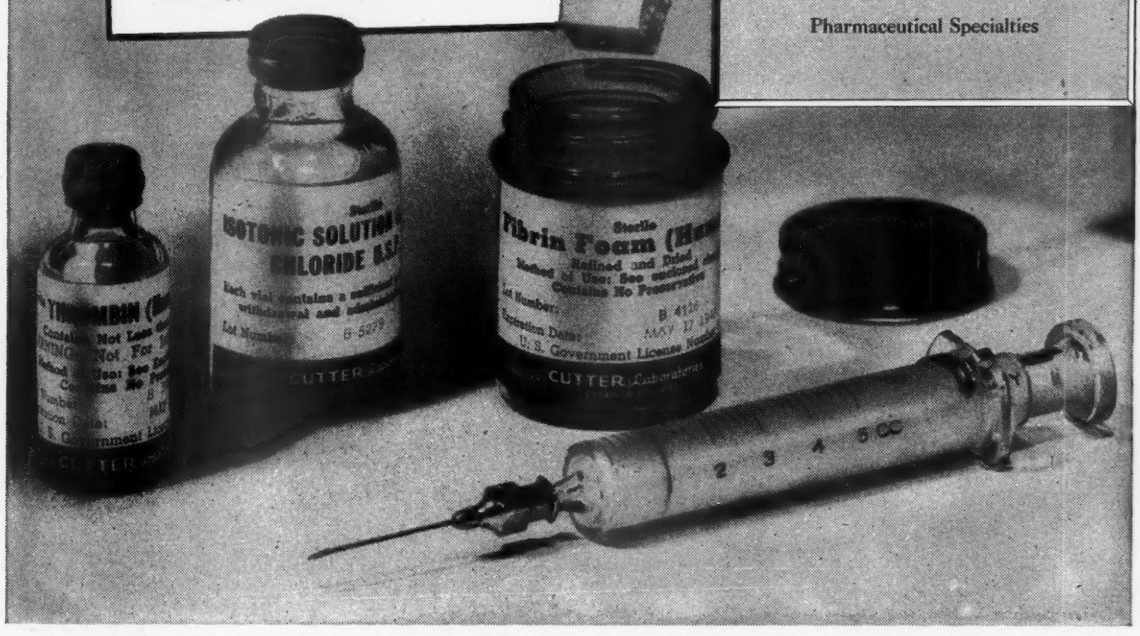

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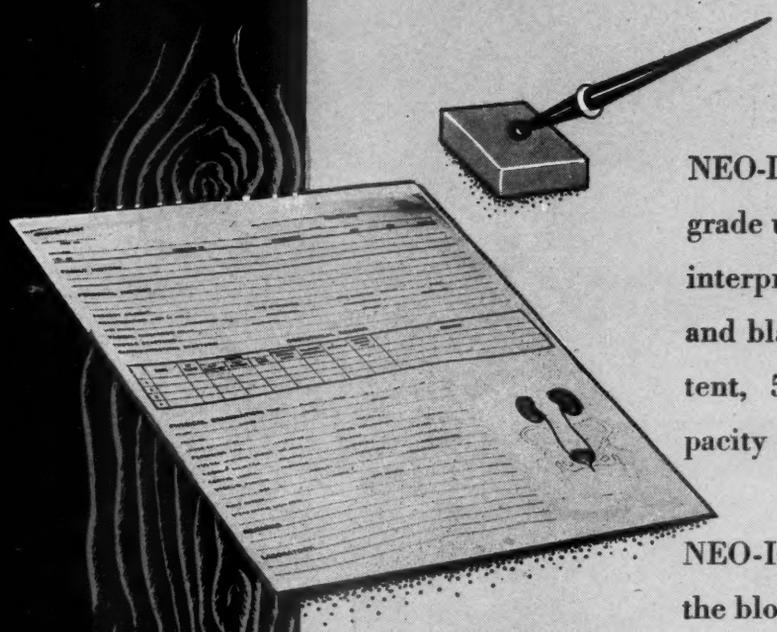

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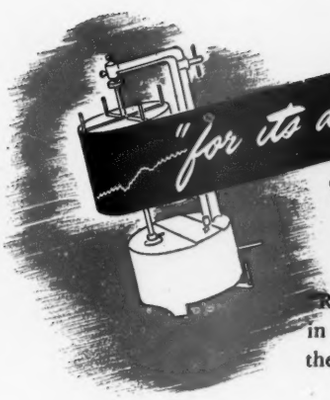

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"Rapid and sustained rise in blood pressure ... (because of) ... decrease in the volume capacity of the vascular depots ... in this way increasing the effective blood volume."

Johnson, C.A.: Surg. Gynec. & Obst. 65:458, 1937.

"... widespread vasoconstriction ... instantaneous effect upon the pulse, which becomes slow and full ... can be continued indefinitely by continuation of ... Neo-Synephrine ..."

**Kelly, M.: Anesth. & Analg. 19:107, 1940.*

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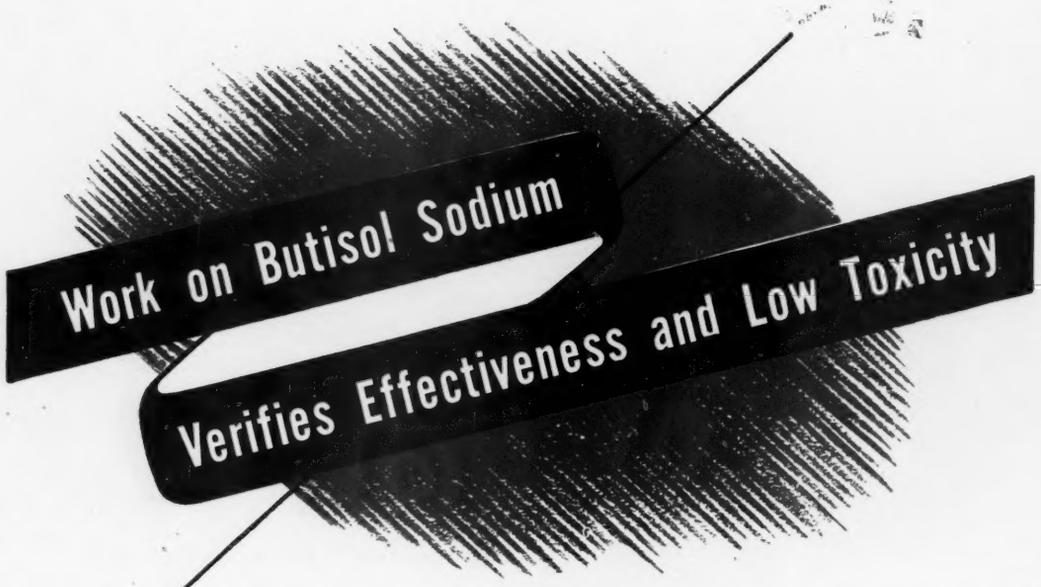
Trade-Mark Neo-Synephrine—Reg. U. S. Pat. Off.

†Rochberg, S.: Anesth. & Analg. 22:174, 1943



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*Gruber, C. M., Ellis, F. W. and Freedman, G. J. Pharmacol. & Exper. Therap. *81*:254 (July) 1944

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Primary repair of uncomplicated skull defect with preformed tantalum plate.

Secondary repair of deforming frontal defect by preformed tantalum plate.

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"THE repair of skull defects caused by war wounds or incidental to casual illness among service personnel has become a major responsibility of the military neurosurgeon," according to Hemberger, Whitcomb and Woodhall, at Walter Reed General Hospital.†

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† Hemberger, A. J.; Whitcomb, B. B., and Woodhall, B.: The Technique of Tantalum Plating of Skull Defects, J. Neurosurg. 2: 21-25 (Jan.) 1945.

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For Every Surgical Procedure

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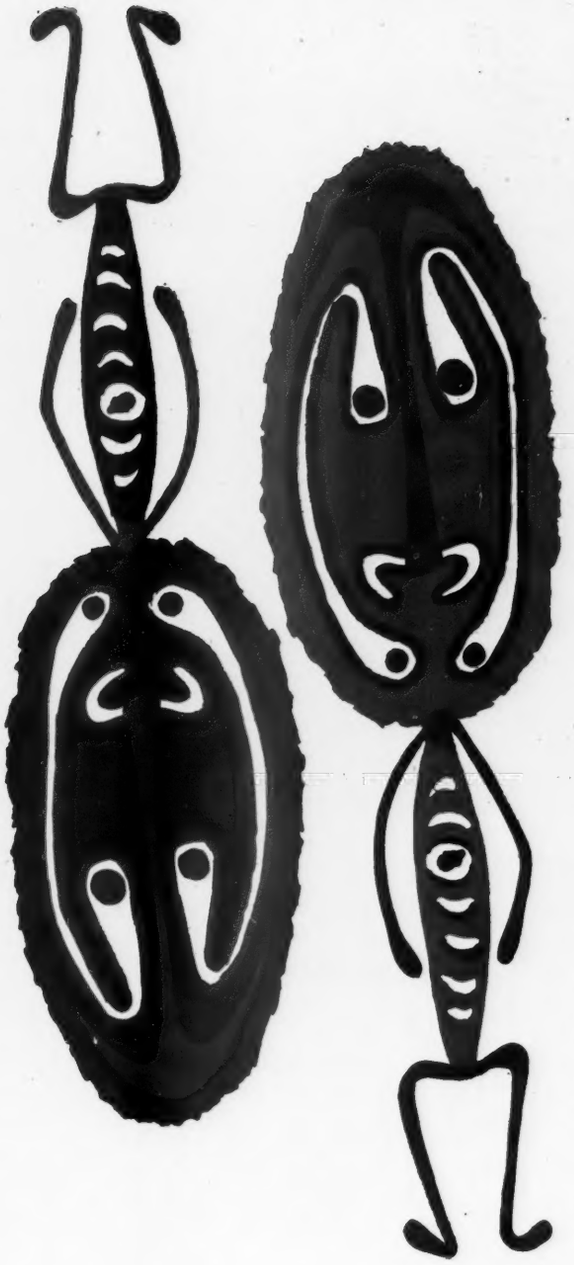

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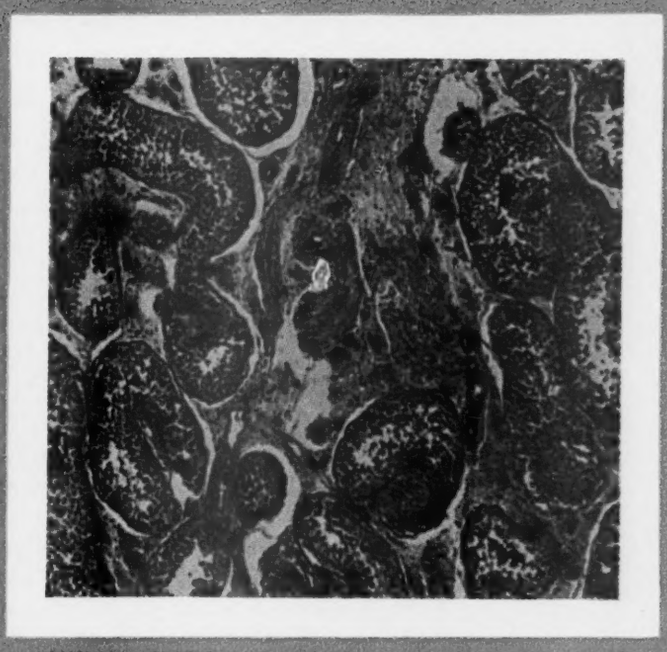

HUMAN TESTIS: Color photomicrograph. Transection of the tubules showing various stages of spermatogenesis. Male, 30 years of age.

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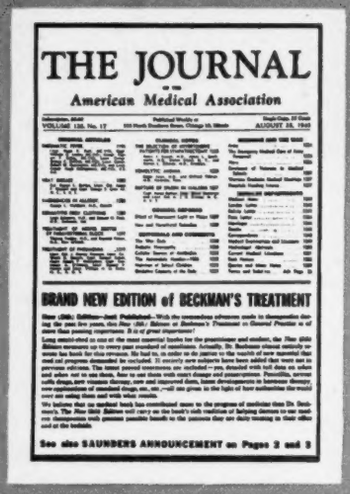
THE JOURNAL
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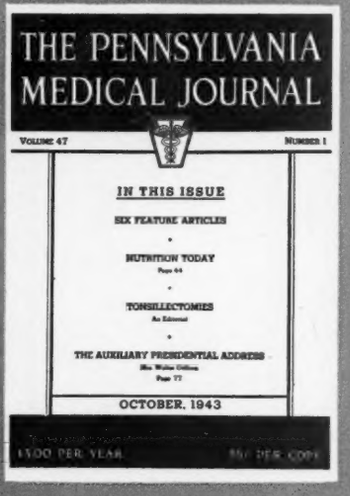
See also SAUNDERS ANNOUNCEMENT on Pages 2 and 3

THE MALE CLIMACTERIC

"There is absolutely no basis for the belief that the man does not have a decrease in sex function in later life and that he cannot have a climacteric. . . . Testosterone propionate, by intramuscular injection of 25 mg. three times a week, has been found effective in relieving the symptoms and in the production of a sense of well-being in the patients, which is the primary objective of this treatment. . . . Testosterone may also be given orally, by inunction and by implantation."—A. A. Werner.

Journal of the American Medical Association, 127:705, 1945.


THE PENNSYLVANIA MEDICAL JOURNAL

VOLUME 47 NUMBER 1

IN THIS ISSUE

SIX FEATURE ARTICLES

NUTRITION TODAY

TONSILLECTOMIES

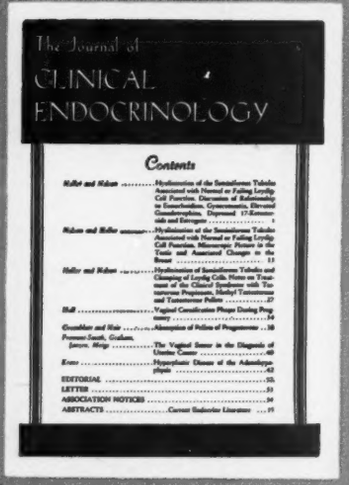
THE AUXILIARY PRESIDENTIAL ADDRESS

OCTOBER, 1943

MALE HORMONE THERAPY

"As many as 34 different symptoms have been observed in the male climacteric; 20 of these are attributable to the nervous system and 9 of them to the circulatory system. . . . Under the influence of adequate hypodermic therapy 10 to 25 mg. of testosterone propionate two to five times a week, the average symptoms of the climacteric are usually relieved. . . ."—C. W. Dunn.

Pennsylvania Medical Journal, 48:780, 1945.


The Journal of
CLINICAL ENDOCRINOLOGY

Contents

CLINICAL USE OF TESTOSTERONE IN THE MALE CLIMACTERIC

"We wish to urge the careful study of men from 50 to 65 years of age when they complain of vague and often apparently unrelated symptoms, for evidence of the climacteric, and a subsequent use of testosterone propionate, in an attempt to relieve their suffering."—S. F. Goldman and M. J. Markham.

Journal of Clinical Endocrinology, 2:237, 1942.

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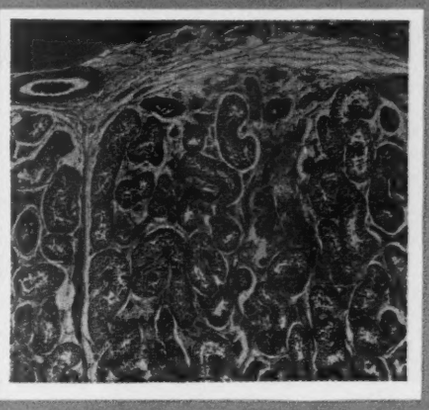
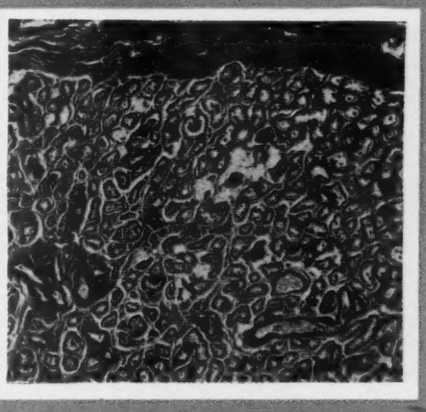


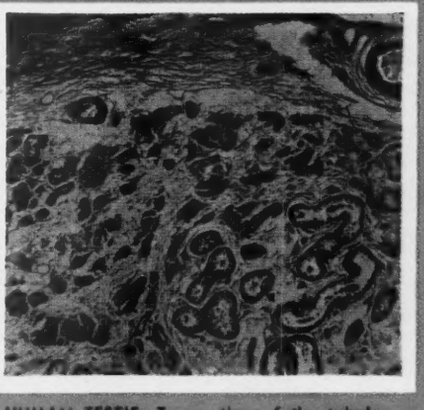
HUMAN TESTIS: Transection of the tubules. Normal male, 30 years of age.

2



HUMAN TESTIS: Transection of the tubules. Moderate atrophy. Male, 59 years of age.

3



HUMAN TESTIS: Transection of the tubules. Atrophy. Male, 65 years of age.

The above microscopic sections represent three stages of the testis in the male involution. The slides are Masson stained and photographed with Kodachrome Professional Film, Type B, 3¼" x 4¼".

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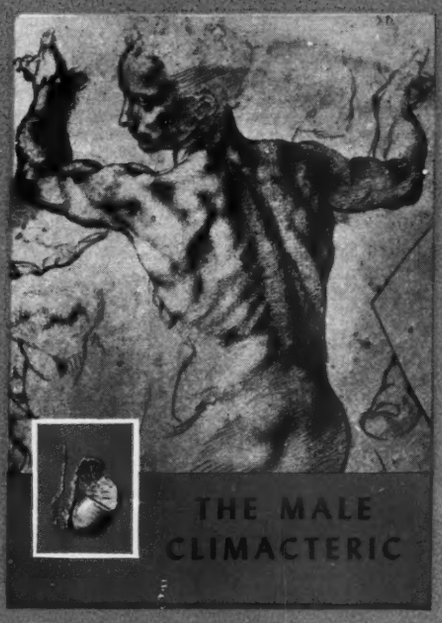

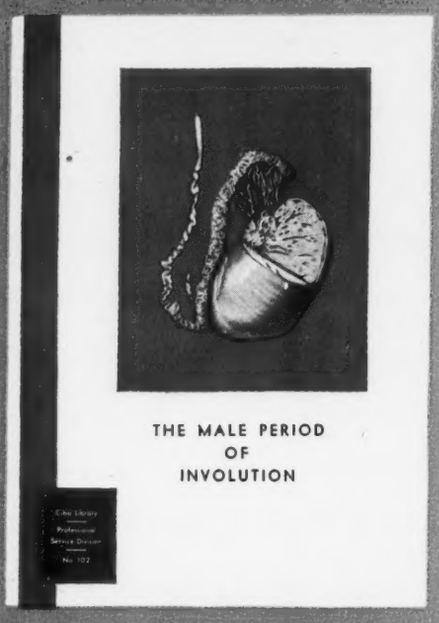

YOU WILL RECEIVE, DURING THE MONTH OF FEBRUARY, THE INTERESTING AND ATTRACTIVE FOLDER SHOWN ABOVE ON THE LEFT. THIS WILL GIVE YOU IN MORE DETAIL, YET IN CONCISE FORM, THE STORY OF THE SUCCESSFUL TREATMENT OF THE MALE CLIMACTERIC WITH THE STEROID HORMONES. IT WILL MAKE QUICK AND WORTHWHILE READING.

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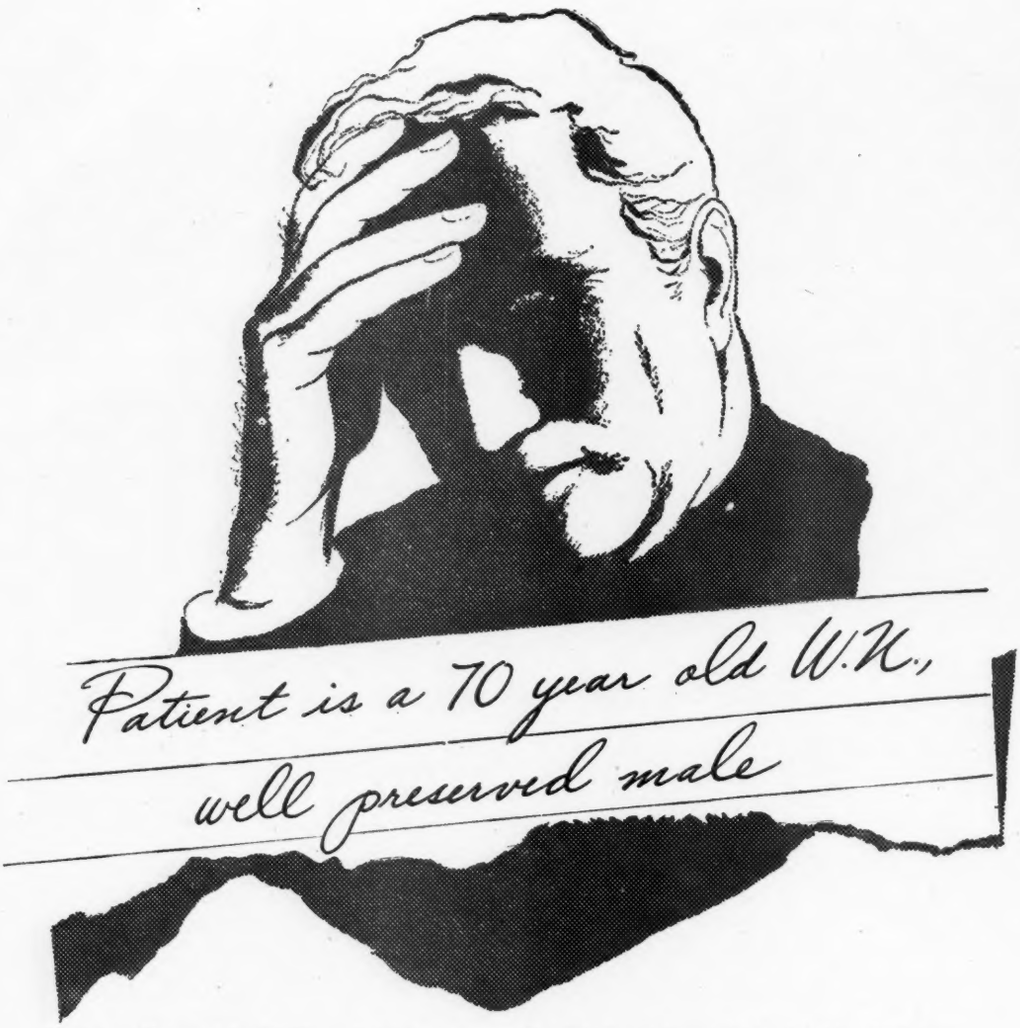

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Basic Formula SQUIBB

1. Spies, Tom D.; Cogswell, Robert C., and Vilter, Carl: J.A.M.A. (Nov. 18) 1944. Spies, Tom D.: Med. Clin. N. Am. 27:273, 1943. 2. Spies, Tom D.: J.A.M.A. 122:911 (July 31) 1943. 3. Jolliffe, Norman, and Smith, James J.: Med. Clin. N. Am. 27:567 (March) 1943.

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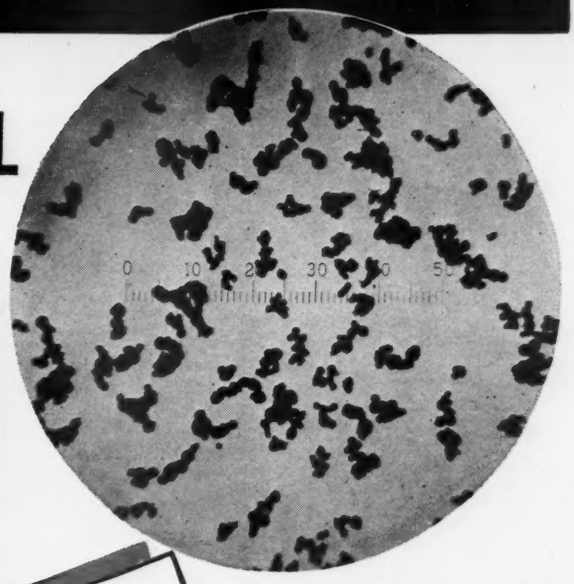

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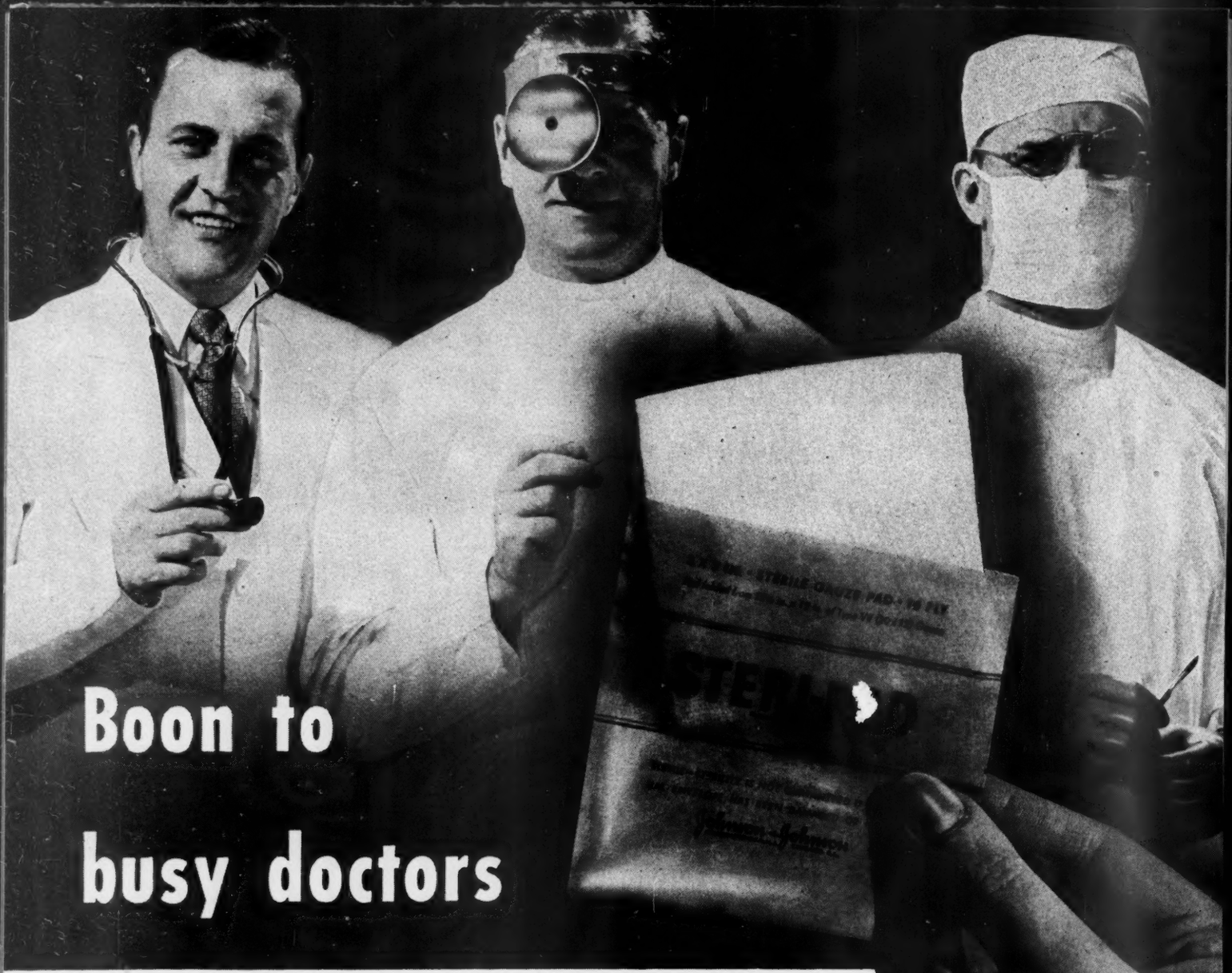

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Fifty-fifth Year of Continuous Publication

VOL. LXXI FEBRUARY, 1946 NUMBER TWO

Editorial

IMPORTANT DIVIDING WALL BETWEEN CAUDAL HERNIATION AND PROLAPSE OF ABDOMINAL OR PELVIC VISCERA

THE great body cavity enclosed by walls known as the cephalad, ventrad, laterad, dorsad and caudad walls, furnishes housing for sensitive structures important to the body economy. While these enclosed structures make connections with functioning structures in other parts of the body and terminal opening connections, the walls are so woven around these terminals and connections, that in most instances the walls remain intact and impervious to escape efforts of enclosed viscerae and structures. To this, however, there are many exceptions, due to structural imperfections, weaknesses, traumas and forces which produce pressure on the walls and contents tending to cause escape of the latter through the former.

The change of the long axis of the body from the horizontal to the vertical position required an extensive engineering feat to provide for the extra weight thrown upon the caudal wall and to so fit the tract terminals into the new formed wall that the integrity of wall tract support would not suffer. If we take advantage of our opportunity for observation, however, there are many mammals that represent the former type of carriage and these teach us many lessons which we may not have followed in the change of position of the human.

In addition to the supporting structure of the walls, each visceral structure has its own ligament or mesentery, composed of peritoneum, connective tissues, nerves, blood vessels and lymphatics, which determine its position in the abdomen and most of these structures have a range of movement determined by increase or decrease of weight, by lengthening or shortening of its mesentery, by force of changing size or fullness of other organs. By the constant force of gravity the trend is almost always toward the lower wall, or toward an escape, but these tendencies may be changed by counter forces. These intra-abdominal movements, to a larger extent downward, are designated by cephaladward, ventradward, lateradward, dorsadward and caudadward. In humans this intra-abdominal movement is to the greatest extent caudadward, and second in extent perhaps ventradward, but under certain conditions there is a marked movement cephaladward.

More common, but perhaps less accurate terms for these intra-abdominal shifts,

drifts or movements are ptosis, descensus, prolapse, ascensus, ascent, backward, forward and lateral position or movement. These are largely the terms which indicate change of position. Another change of position in these structures is fairly common and toward, into and through an opening, defect or weak place in the wall. This may be in almost any direction if intra-abdominal pressure is considerable, but in a downward direction gravity is added to intra-abdominal pressure and so herniation is far more common through the caudad region and the caudoventrad region.

There is no difference of opinion about protrusions of viscerae into or through the abdominal wall constituting hernias in the cephalad, ventrad, laterad and dorsad walls. There should be no further difference of opinion in regard to protrusions through the caudad wall. They are abdominal organs forced by gravity and intra-abdominal pressure to protrude into and through the musculofascial caudal wall, known as the pelvic floor, through the anterior or posterior pelvic floor slit, usually enlarged by trauma. This definitely constitutes a hernia. There are many who admit that these are hernias, but find their adjustment too difficult when they want to become teachers and so write under the title of "Hysterectomy for Uterine Prolapse" or "Sigmoidopexy for Rectal Prolapse."

Here then is the dividing line between prolapse, an intra-abdominal faulty position, and herniation a visceral protrusion. Prolapse is a downward wandering of structures in the abdomen, and they may eventually reach the pelvis or the pelvic floor. Herniation is a wandering of viscera or intra-abdominal structure, into, through or outside the abdomenal wall and may in this caudal region be dangling between the patient's thighs. There was a downward trend in the abdomen that could be considered prolapse. Any structure that crosses the threshold of the musculofascial floor becomes a herniation and is subject to a new line of evil influences, exposure, infection, irritations, pinching, constricted circulation, resulting in edema, ulceration, rough contacts, etc. This is so marked that there is a vast difference between the part of the bladder herniated and that in the pelvis. One part is above the musculofascial pelvic floor diaphragm and one part is below. A pelvic structure comes to the caudal wall a movable structure, it crosses and it is no longer just a movable structure; it has become a herniated structure with a hernial ring and harm-producing influences.

This musculofascial wall which lies between prolapse—downward wandering in the abdomen, and hernia—tissue wandering outside the abdomen, is the caudal wall, composed of five layers of fascia and three layers of musculature, "faulted" by clefts for tract terminals, and impaired by childbirth, trauma, or surgical oblique episiotomy, injury or destruction. If we have herniation, downward displacement is implied and accepted. We do not mention prolapse with a scrotal or femoral hernia. Gallbladder prolapse would have preceded gallbladder herniation, if found in an umbilical hernia; but to treat it on the basis of prolapse would lead to erroneous and harmful surgery. The dividing line is the hernial ring and to treat the major pathological condition, the minor instance is forgotten.

Ptosis, descensus and prolapse signify by etymology and common use, downward displacement, but in no sense hernia; for example, ptosis, descensus or prolapse of the stomach, gallbladder, transverse colon, kidney or other organ or combination of organs.

A familiar example in four-footed animals is prolapse of any structure toward the low point, the umbilicus. Protrusion of any abdominal contents through the umbilical opening, whether originally located near or far, is a hernia, but usually termed in a four-footed animal a rupture or a breach, but never a prolapse in spite of its definitely downward trend, and fre-

quently lack of peritoneal sac. The more common names of rupture and breach used in animals and in less scientific circles, in reference to hernias in the human, carries the implication of a trauma, a breaking through, a giving way of walls. Prolapse, ptosis, descensus implies no participation of the abdominal wall and frequently has not included the wall in the treatment of so-called visceral prolapse, which has been directed principally against "uterine prolapse" and "rectal prolapse."

Strangely significant, however, is the fact that these caudal hernias, treated by most surgeons under the name of uterine and rectal prolapses, have a higher percentage of definitely traumatized wall etiology than do all other hernias combined. In fact, extensive caudal herniation in non-childbearing women is a rarity, and childbearing women definitely trace their genital and rectal herniations to childbearing traumas in a large majority of instances, and a traumatized musculofascial ring can be palpated as of hernial size.

It seems uncontrovertible then that the terms ptosis, descensus and prolapse as applied to visceral structures, refer to conditions inside the abdominal wall, and the terms hernia, rupture, breach, and terms ending with the suffix "cele" refer to abdominal wall conditions in which structures are finding or have found their way through an opening. In regard to the caudal area the one set of terms means conditions above the pelvic floor, but having worked toward it, while the latter set of terms refers to defective pelvic floor with protrusion of viscera through these openings tending to travel lower.

In regard to the ancient vintage and almost universal use of the term "prolapse" to apply to escape of abdominal viscera through the caudal wall, but not through other portions of the wall, it seems appropriate to call attention to several terms which by their common suffix indicates that some one, even in older times, recognized the hernial nature of conditions which are in other regions called hernias, but unwisely, called in this region prolapse and procidentia, words very poorly chosen etymologically to represent their meaning.

Beside having the merit of long use, these terms ending in "cele" signifying hernia, have the advantage of definite application to different limited parts which may have reached a hernial stage at a given time, such as urethrocele, cystocele, colpocele, rectocele, uterocele, proctocele, and enterocele, for which we might substitute megalo cul-de-sac when it remains above the pelvic floor, and might well employ the term cul-do-cele when it finds its way through the pelvic floor.

The above terms are self-explanatory as to the structure herniating, but there has been rather loose use of the terms as to what they may be herniating into or through. Cystocele is erroneously quite commonly used to mean a bulging of the bladder into the vagina. A rectocele is said by some to signify a prolapse of the rectum into the vagina, a use of the term quite as improper as the above. The common conception of an enterocele is that it is a large, low posterior cul-de-sac bulging into the vagina, a use of this term entirely unwarranted.

To clear up these misconceptions we may say that none of the terms are entitled to the suffix "cele" until they have fulfilled the requirements for a hernia, and none of them fulfill this requirement until some portion of the named structure passes through the abdominal wall, which here is the musculofascial pelvic floor. The pelvic organs of vagina, bladder, rectum, uterus, nor cul-de-sac, are hernial sacs, canals, tubes or repositories. On the other hand, they become the herniated structure when having passed below the pelvic floor:

Urethrocele.....	an inversion through the urethral opening through the pelvic floor
Urethro colpocele.....	a herniation of the urethra and vagina through the pelvic floor slit

Colpocele	a slight herniation of vagina through the pelvic floor
Cysto colpocele	herniation of bladder and vaginal wall through the pelvic floor
Utero colpocele	herniation of uterus and vagina through the pelvic floor
Urethro cysto recto colpo uterocele	an extensive herniation of urinary, genital, rectal tract through the anterior pelvic floor opening
Proctocele	herniation of rectum through posterior pelvic floor slit
Procto colpocele	same as recto colpocele
Entero colpocele	if and when they pass through the anterior pelvic floor slit
Entero proctocele	when they pass through the posterior pelvic floor slit
Enterocele, cul-do-cele	if and when the cul-de-sac passes through the pelvic floor between the vagina and rectum
Megalo cul-de-sac	a large posterior cul-de-sac not yet having herniated through the pelvic floor

The vagina does not herniate far without the bladder and rectal wall. The bladder does not herniate through the pelvic floor without being accompanied by the vagina, and the same could be said of the rectum herniating through the anterior pelvic floor slit.

It would then be quite improper to speak of a cystocele or rectocele. The usual conditions are urethro colpocele, urethro cysto colpocele, cysto colpocele, a recto colpocele, and utero colpocele and different combinations. The bladder, the rectum, and the uterus find no hernial ring until the pelvic floor ring is reached, and can constitute no herniation previous to this pelvic floor herniation.

The above rather extensive group of herniations of urethra, bladder, vagina, rectum, uterus and cul-de-sac, constitute a condition which could reasonably be called herniosis, for no one or several of these terms could be applied without leaving some portions out. The term herniosis implies pelvic injuries and defects of a widespread nature through which all or many of these "celes" are breaking through. Aside from these herniations and perhaps added to them, is shown a decided tendency to herniation in the umbilical, ventral, inguinal or/and femoral regions. I submit the term "herniosis" for careful consideration.

All conditions of loss of pelvic floor integrity with herniation of viscera require a careful engineering plan and reconstruction, as the hernioplastic repair must take into consideration not only efficiency of pelvic floor support, but urinary, genital and rectal supervision which calls for functional support without complete closure.

This calls for (1) adequate supporting reconstruction of the injured musculofascial caudal wall; (2) frequent repair of rectal wall and sphincter muscle; (3) at times closure of vesico- and rectovaginal fistula; (4) dissection of excessive scar tissue; (5) fascial support of bladder, vagina and rectum; (6) proper narrowing of sacculated rectum, vagina and bladder; (7) oblique placing of the narrowed vaginal tube directed from the symphysis upward and backward; (8) horizontal placing of the uterus, fundus forward, cervix backward; (9) equal attention should be given to reconstruction and placing of the vagina if the uterus requires removal; (10) normal position and placing of the uterus if left in, no hiding or burial operations, as abdominal wall burial, interbladder-vagina hiding of all or part of the uterus, the Le Fort interment, etc.; (11) above all, in restoring pelvic floor integrity we would emphasize no effort or carelessness in by-passing the musculofascial diaphragm, composed of five layers of fascia and three layers of muscle, so wisely formed to create pelvic floor integrity for the upright position; (12) successful repair of moderate pelvic floor injury need not contraindicate pregnancy or delivery through the normal route. After extensive and complicated successful repair, pregnancy may not be, and usually is not, contraindicated, but Cesarean section may be the wiser choice for delivery, on account of possible irreparable damage which might take place. (13) Ptosis, descensus, prolapse refers to the phenomenon of downward wandering or a lowered position of intra-abdominal

organs. Hernia, rupture, breach and the suffix "cele" refer to the "protrusion of viscera into, through, or outside, the abdominal wall in any direction or locality, whether floor, walls or roof, and regardless of presence or absence of peritoneal sac." (Stone). (14) The break through of urethra, bladder, rectum, uterus, anterior and posterior cul-de-sacs with perhaps other important structures, may justly be termed *pelvic floor herniosis.*

CHANNING W. BARRETT, M.D.

Correction: We wish to correct an error made in our January 1946 issue. The illustration for Figure 21, on page 137 in Dr. Jarcho's article, was printed upside down. A correction is being made in the reprints.

Original Articles

URINARY INCONTINENCE*

WITH SPECIAL REFERENCE TO CERTAIN FACTORS WHICH ARE NECESSARY IN THE CURE OF THIS CONDITION

INGLIS F. FROST, M.D.
Clinical Assistant, Woman's Hospital
NEW YORK, NEW YORK

PROBABLY no operation in gynecology is approached with as much apprehension from the standpoint of the end result as that for the cure of incontinence of urine in the female.

Kelly,[1] in his "Practice of Gynecology," states that "The list of the operations devised to overcome incontinence is legion, mostly unsuccessful but occasionally, temporarily at least, affording some control; again working by destroying tissue, or as in the twisting operation, ending in an extensive slough."

Over a period of years numerous operations have been devised for the cure of incontinence. Some have given temporary relief, others permanent relief, but until there is a better understanding of the anatomy of the urethra and the mechanism of its control, all operative procedures will remain in the stage of experimental surgery.

During the past few years there has been a vast improvement in the operative technic and the end results have been more gratifying. There still remain, however, the cases that seem to baffle all attempts at cure. Many times these cases have had previous operations and with each operation there is added trauma and destruction of tissue.

The various types of operation which have been devised for the cure of incontinence may be divided into several groups:

Kelly's[2] plication of the posterior portion of the urethra in the region of the vesical neck is probably the best known and most widely used. With this operation we associate the names of Ward, Rawls, Farrar and Finley Douglass. The use of contiguous muscle under the urethra in an effort to constrict it was advocated by Deming, H. Martius, Taussig, Stoeckel, Selheim and others. Combined plication[3] of the urethra and bladder was advocated by such surgeons as Bonney, J. G. Clark, Davies, Watson, Royston and Rose. Suprapubic plication of the vesical neck, was suggested by Furness. Other operations,[4] more rarely used at the present time, are the urethral advancement operation devised by Pawlick and improved by Dudley, and also the urethral, twisting with advancement, as used by Gersuny, Pawlick and Ries.

To the above may be added the newer operations as performed by Kennedy, Aldridge, Studdiford and Meigs. These surgeons have used wider dissections of the urethra and support under the urethra, either by metallic means or strips of fascia derived from the abdominal wall.

While this paper is not an attempt to offer anything radically new in the way of an operation for incontinence in the female, it is an effort to evaluate important steps in the operation and to describe a new technic for the support of the urethra and

* Presented before the New York Obstetrical Society May 8, 1945.

bladder, especially where the incontinence has been accompanied by a urethrocele and cystocele.

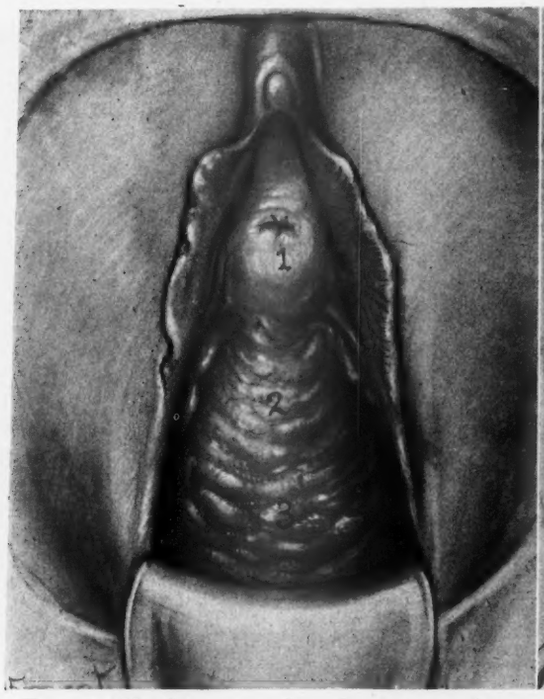

Fig. 1. 1, Urethra; 2, urethrocele; 3, cystocele.

It would seem that if the first operation were successful we will have gone far in solving this problem.

While urinary incontinence may be a separate entity, it is most commonly associated with urethrocele and cystocele of lesser or greater degree. The causative factor is most often birth trauma and the resultant hernia, vesico-urethral. At times, associated with this, there is a downward rotation of the urethra under the symphysis.

Before discussing the operative technic of these conditions, it may be both interesting and instructive to review briefly the history and development of anterior vaginal wall plastic surgery.

Modern plastic pelvic surgery owes its origin to the early attempts of gynecological surgeons to cure prolapse of the uterus. While these attempts were crude and unsatisfactory in the light of our present-day knowledge, they formed the basis upon which our present-day surgical technic has been developed.

The early part of the last century[5] marked the beginning of surgical efforts to replace the prolapsed uterus. These

Fig. 2. 1, Mushroom catheter, size No. 12; 2, vesical neck of the bladder (note shortened urethra); 3, tip of mushroom catheter at site of urethrocele; 4, cystocele—note thinned out portion of bladder wall; 5, smooth capsule of bladder wall; 6, anterior vaginal wall; 7, area of dissection under the pubic rami.

efforts were directed mainly at replacing the uterus and endeavoring to secure its position by stricture of the vaginal canal by the use of caustics, cautery and chemical agents.

In 1823, Romaine Girardin suggested an operation for the occlusion of the vaginal canal, but it was not until 1828 that Dieffenbach first performed colporrhaphy for uterine prolapse. He accomplished this by excising areas on each side of the vaginal wall and closing the raw areas with sutures.

Heming, in 1831, denuded a strip of tissue from the anterior vaginal wall and placed interrupted sutures in an effort to raise the prolapsed uterus to a higher level.

The following year Ireland performed a similar operation, but modified it by

adding a denudation on each side of the anterior vaginal wall.

In 1849, Huguier called attention to the fact that in certain cases of uterine prolapse there was an elongation of the cervix and devised an operation for conical amputation of that part of the uterus.

Baker Brown, in 1853, performed an operation wherein he denuded the lower portion of the vulva and perineum by means of a horseshoe incision. The denuded areas were sutured with both deep and superficial sutures. If a cystocele were present, a further denudation was done on the labia, just below the external urinary meatus.

Stoltz, of Germany, Savage and Geddins performed similar operations at about the same time.

Both Sims and Emmet were familiar with Brown's technic and used it, but were disappointed with their results.

In 1856, Sims achieved his original colporrhaphy. This he did by accident while attempting to cure a cystocele. To quote from Sims' original record: "My surprise was equalled only by my delight, when I found that I had not succeeded in doing what I had intended, for instead of excising the base of the bladder with the anterior wall of the vagina I had by the tenaculum, simply raised the hypertrophied vaginal tissue up between the blades of the forceps, luckily separating it from the living membrane of the bladder."

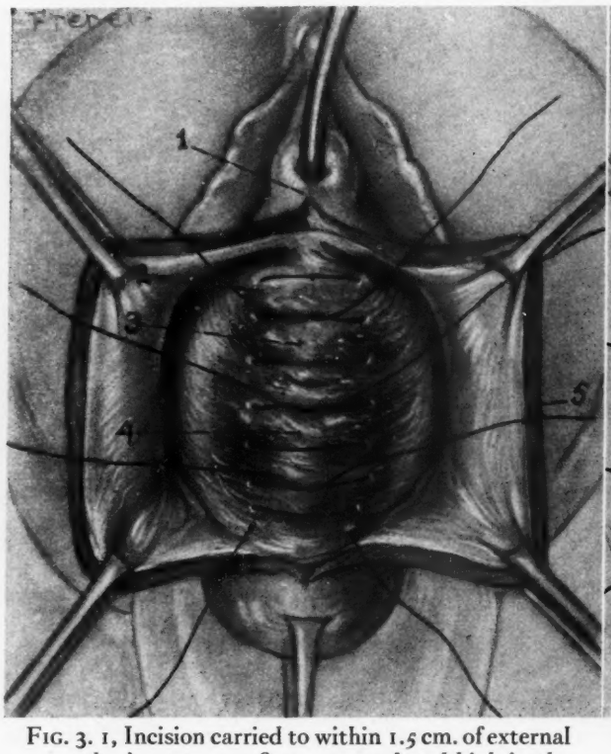

FIG. 3. 1, Incision carried to within 1.5 cm. of external urethral meatus; 2, first suture placed high in the urethra; 3, second suture placed in region of the vesical neck; 4, remaining mattress sutures placed in region of cystocele; 5, anterior vaginal wall.

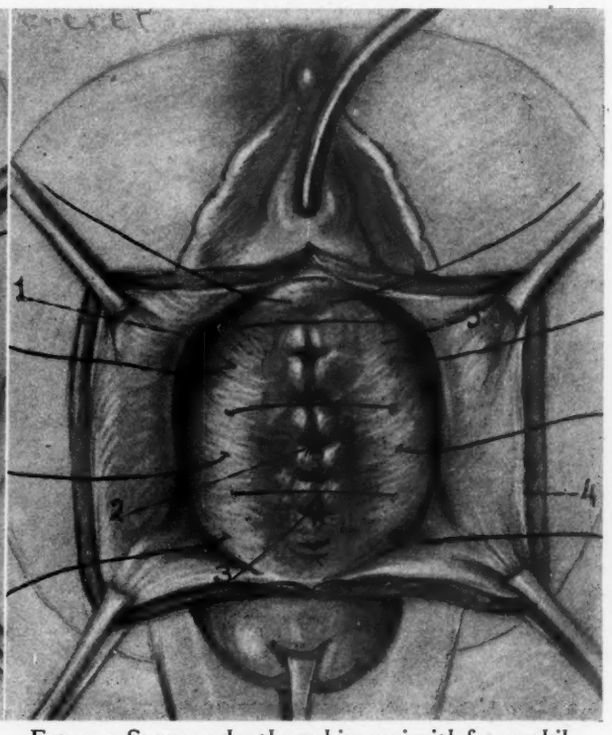

FIG. 4. 1, Space under the pubic rami with free mobilization of the urethra; 2, first row of sutures tied; 3, second row of sutures in the bladder; 4, anterior vaginal wall; 5, smooth capsule of bladder wall.

Two years later Sims abandoned his exposure of the bladder and adopted his V-shaped denudation operation.

In 1862, Emmet converted Sims' V-shaped incision into a triangular denudation, and in the same year Sims modified his own incision and adopted a trowel-shaped denudation.

In cases complicated by an excess of tissue around the urethra or with a urethrocele, Emmet used a heart-shaped

denudation in addition to his denudation of the anterior vaginal wall.

To Emmet must be given the credit for first recognizing the importance of the fascia of the anterior vaginal wall as a means of support in prolapse of the uterus. He said of his operation for prolapse "that a direct lateral support is gained from the pelvic fascia."

Emmet's anatomical findings were not generally recognized and there was a return to the older methods of attempts at occlusion.

In 1888, Donald,[6] of Manchester, England, performed five operations for uterine prolapse by means of an anterior and posterior colporrhaphy. This he did by means of a wide, diamond-shaped incision, including excision of the cervix, and drew the deep tissues together with a buried spiral suture of catgut.

In 1872, Thomas,[7] realizing the importance of separating the anterior vaginal wall from the bladder, improvised an instrument which he passed through a small incision in the vaginal wall.

Fig. 5. 1, Strip of tissue from the anterior vaginal wall (entire thickness); 2, second row of sutures in the bladder; 3, denuding the mucous membrane from the strip of the anterior vaginal wall.

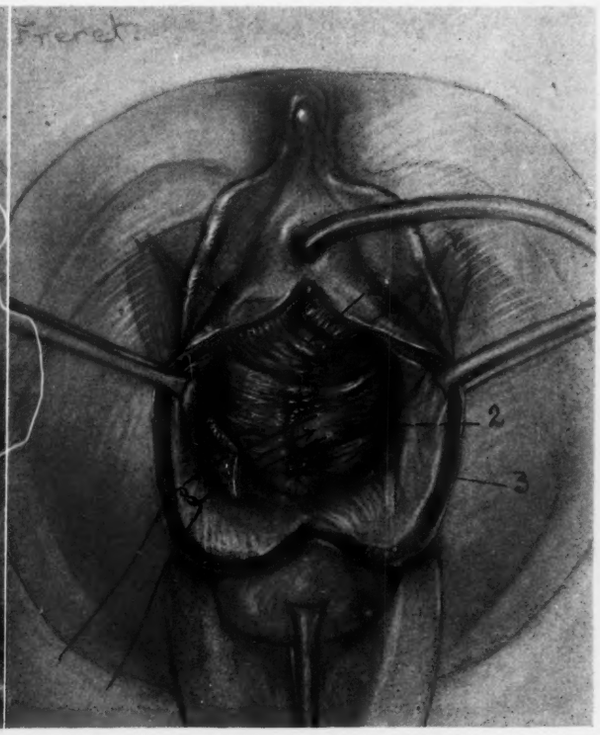

Fig. 6. 1, Strip of tissue from the right side of the anterior vaginal wall sutured under the pubic rami of the left side; 2, excess portion of tissue sutured to that of the opposite side in the region of the vesical neck; 3, anterior vaginal wall.

It was not until 1887 that Hadra,[8] of Texas, first suggested "flap-splitting" of the anterior wall of the vagina and the freeing of the bladder from the cervix. One year later he published his findings, but they were not generally adopted until many years later.

The following year Sanger and Noble used the general method of Hadra and improved the technic of his operation.

Munde was probably the first to describe cystocele as a hernia, while Skene was the first to operate on a cystocele from the standpoint of a hernia. A few years later Gersuny adopted the method of elevating the bladder by means of a purse-string suture passed into the fascia of the anterior vaginal wall.

J. Riddle Goffe, in 1902, advocated a wide dissection of the bladder so as to free

it from its attachment to the vagina and cervix. He recommended that the excess of bladder wall be transposed to the peritoneal cavity and sutured to the body of the uterus and broad ligaments.

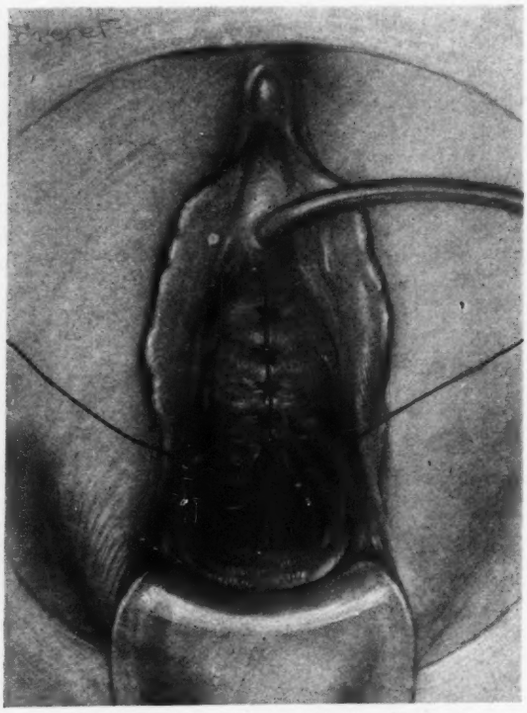

FIG. 7. Closure of anterior vaginal wall with interrupted sutures.

In Manchester, England, Donald's operation for anterior and posterior colporrhaphy had been steadily extended and had given excellent results. Fothergill, a pupil of Donald, had written extensively of this operation and emphasized the necessity of using deep sutures in the base of the broad ligaments to augment the support of the uterus.

In this country and in Germany the tendency was more towards flap-splitting, free mobilization of the bladder with advancement, and the use of the so-called uteropubic ligaments for bladder support.

This type of operation was performed by Stone[9] in 1901 and later by Kreutzmann, Sipple and Violet. A similar operation was described by Martin in 1911.

In 1917, Frank and Rawls published papers describing an operative technic for cystocele. Rawls' operation advocated the fascia-lapping of Bissell for support of the bladder.

Halban, in 1919, advocated free mobilization of the bladder from the uterus and fascia. He then severed the vesicovaginal fascia at the level of the internal os. A purse-string suture was used to gather up the excessive fascia and attach it to the cervix at the level of the internal os.

Ward, in 1919, presented his operation for cystocele and advocated the use of the uteropubic fascial ligaments to reinforce the support of the bladder. This operation he termed "cystopexy" and stated it to be a combination of the operations of Hadra, Goffe, Martin, Frank, Alexandroff and Sims.

In 1929, Bissell studied sections from the anterior vaginal wall and found that they contained no definite fascial layer which could be defined as such. He believed that most of the support came from the musculature of the vaginal wall and that the lapping of this musculature gave added strength and support.

Goff's histological studies bore out the findings of Bissell. His conclusions were: "The successful surgical correction of cystocele, rectocele and urethrocele depends on the utilization of the tissue of the vaginal wall rather than on the use of the fragile areolar fascia which surrounds it."

J. G. Clark's operation[10] for anterior colpoplasty was a radical departure from the ideas of his contemporaries. He advocated complete separation of the anterior vaginal wall from the bladder. This separation was carried well down on the sides of the bladder and exposed the urethra to its upper third. Clark stressed that in removing the vaginal wall from the bladder care should be taken "to leave the thin aponeurotic membrane which will be found investing the bladder." He further stated: "This will be seen to be slender and attenuated at the center of the cystocele, but strong and well marked on the sides." He then sutured the bladder, using a continuous suture to infold the bladder.

This suture was carried well out on the sides so as to include the aforementioned "aponeurotic investure." If incontinence accompanied the cystocele, three mattress sutures were placed through the vaginal wall directly over the urethra.

Davies,[11] in 1939, published an article on cystocele in which he described hernia of the bladder to be due to a rupture of the mesovesico. He advocated complete mobilization of the bladder from both the cervix and vaginal wall and stated: "A smooth, glistening, fibrous tissue intimately attached to the bladder is exposed lateral to the roughened bleeding area which represents the midline tear through which the bladder herniates." He recommended that mattress sutures be placed in the bladder wall to close this hernial opening.

Kennedy,[12] in his operation for incontinence, also emphasizes the necessity of complete mobilization of the bladder and urethra. This is accomplished by carrying the vaginal wall incision from the cervix to within 1.5 cm. of the external urinary meatus. The dissection is then carried laterally to the pubic rami on each side. All adhesions between the urethra and the pubic rami are separated and the dissection is extended to the paravesical space and under the symphysis on both sides, thus completely mobilizing the urethra and the bladder.

In 1942, Aldridge[13] published an operation for stress incontinence. This operation utilizes fascial strips from the aponeurosis of the oblique muscles. These strips are passed downward under the pubic bone and sutured under the urethra to form a sling support.

A great deal of credit must be given to Kennedy[14] for his work in demonstrating and defining the various "states" of the bladder. This he accomplished by means of *x*-ray graphs, using an ingenious instrument made up of a small sac attached to a manometer and inserted into the bladder. This sac, containing a media, in conjunction with a contrast media in the bladder, shows not only the contour of the bladder but the outline of the urethra as well.

Kennedy[15] describes three "states" of the normal bladder, namely, "the holding state," "the relaxing state," and "the voiding state." The incontinent patient remains constantly in the voiding state and is unable to resume the normal holding state due to the relaxation of the vesical neck and the lack of control of the voluntary muscle of the urethra.

In early gynecology[16] the term urethrocele was used only in referring to a sacculated urethra, sinus of the urethra or urethral diverticulum. In later years the term has been used more generally in the sense of a definite hernial protrusion of the urethra in the region of the vesical sphincter.

Graves[17] says: "The descent of the bladder may include the urethra, and when this takes place the condition is termed urethrocele. Urethrocele is usually only an incidental part of the process of cystocele but may occur alone."

Curtis[18] states that urethrocele is a prolapse caused by a laceration of the supporting vesicovaginal fascia, causing the urethra to rotate downward around the pubic bone. Furthermore, he adds that relaxation of the vesical sphincter is commonly present.

If the vesical sphincter constitutes the normal division between the bladder and the urethra, it therefore must be the dividing line between a urethrocele and a cystocele. In many cases where the vesical sphincter is relaxed, there is a merging of these conditions, thus causing a combined cysto-urethrocele.

Hernial protrusion of the bladder, commonly spoken of as cystocele, is more often a combined cysto-urethrocele, involving the base of the bladder and urethra in the region of the vesical neck. This condition would naturally shorten the urethra, as measured from the vesical sphincter to the external meatus.

The length of the normal urethra, according to Piersol,[19] is about 4 cm. During

the past few years it has been our practice to measure the urethra in all patients with incontinence, urethrocele and cystocele. For this purpose we use a No. 12 F. mushroom catheter marked off in centimeters.

We have found that the incontinent patient with a urethrocele and cystocele invariably has a relaxed vesical sphincter and shortened urethra. However, this condition is not confined to the incontinent patient because it is found frequently in patients with cystocele and urethrocele who are not incontinent.

This fact leads us to the natural conclusion that a relaxed vesical sphincter is not the sole cause of incontinence, but that added factors play a part in producing this condition. These undoubtedly include damage of the voluntary muscle system of the urethra. If this is true, the mere tightening of the neck of the bladder by plication and failure to correct the damaged urethral muscle, may be the explanation of many of our operative failures.

Because of the close association of incontinence, urethrocele and cystocele and the fact that incontinence is but a result of further damage to the urethra by the original trauma, it would seem rational that operative treatment should be directed primarily to the bladder and urethra.

The successful treatment of any hernia consists in ligation of the sac, restoration of the herniated part to its normal habitus and support of the area where the hernia originally developed.

The improvement in the operative results in vesicovaginal fistula was due to the realization of the fact that a freely mobilized bladder was necessary to the placing of the sutures without tension. This corollary should be applied to the operation for incontinence. Plication of the bladder without tension is essential.

In order freely to mobilize the bladder all adhesions must be separated. This includes separation of the bladder from the anterior vaginal wall, posteriorly from the cervix as far as the uterovesical fold, laterally until the vesicovaginal fascia is visualized as a smooth capsule, and upward laterally under the pubic rami on each side to free the urethra. The operative procedure is as follows:

At the cervicovaginal junction an incision is made through the complete thickness of the anterior vaginal wall to the vesicovaginal areolar fascia. At this natural line of cleavage the anterior vaginal wall is incised in the midline, exposing the bladder.

With a gauze-covered finger the bladder is separated from the anterior vaginal wall and the incision in the vaginal wall is carried to within 1.5 cm. of the external urinary meatus.

The bladder is now separated from its fascial attachments and freely mobilized. At this point a No. 12 F. mushroom catheter, marked off in centimeters, is inserted into the bladder to localize the vesical sphincter, and left in place until the completion of the operation.

Plication of the urethra and vesical sphincter is accomplished by the use of an intestinal atraumatic No. 00 chromic catgut suture.

Mattress sutures are placed, beginning just below the external meatus and carried posteriorly to the base of the bladder, including the vesical sphincter. The point of starting is optional as some operators prefer to begin the plication in the region of the vesical neck.

Care must be observed not to constrict the ureteral orifices at this point, as they lie posteriorly about 3 cm. from the vesical sphincter.

A second row of sutures is placed in the same manner, invaginating the first row.

The vesicovaginal fascia will be seen to be attenuated in the region of the vesical sphincter. This part of the bladder requires special attention as the stronger vesicovaginal fascia is at the sides of the bladder and must be approximated in the midline. This is the weak point of a cystocele and urethrocele.

Additional support should be given to the repaired urethra and neck of the bladder.

Because of the presence of voluntary muscle tissue contained in the anterior vaginal wall, it occurred to us that if we could use this tissue it would aid materially in improving the control of the repaired urethra and help to maintain the urethra and bladder in their normal positions.

This is especially desirable where there has been a downward rotation of the urethra.

This procedure is as follows:

Two strips of tissue 4 cm. in width are excised longitudinally from the whole thickness of the anterior vaginal wall on either side of the original mid-line incision. These strips are left attached at their point of fusion with the urethra.

Both tissue strips are carefully denuded of their mucous membrane, crossed under the urethra and sutured to the undersurface of the symphysis, each on its respective side.

These sutures are carried first through the periosteum of the symphysis as close to the White line as possible, and then through the strips of tissue about 3 cm. from their point of attachment to the urethra. When these sutures are tied the urethra is drawn upwards and backwards under the symphysis and is maintained in this position by the sling effect of the crossed tissue strips.

The excess distal portion of the strips are now sutured to one another in the region of the vesical neck of the bladder. This suture should include a portion of the bladder. The urethra and bladder now have the advantage of a double support.

The anterior vaginal wall is now closed by interrupted sutures and a Kennedy vitallium catheter and packer are installed and left in place for seven days. This allows the sutured urethra and bladder wall to heal without interference.

CONCLUSIONS

1. Free mobilization of the urethra and bladder is important in the cure of incontinence of urine in the female.
2. Plication of the urethra and base of the bladder should be done without tension.
3. Plication should include the urethra from a point just below and lateral to the external urinary meatus and continued posteriorly to a point which includes the vesical sphincter, thus lengthening the urethra, repairing the damaged voluntary muscle and relaxed vesical sphincter.
4. Added support to the urethra and bladder by means of tissue strips excised from the anterior vaginal wall, and sutured to the undersurface of the symphysis and vesical neck, respectively.
5. Incontinence of urine in the female should be considered as the result of a damaged bladder and not as a separate entity. Its treatment should be directed toward restoring the urethra, vesical sphincter and base of the bladder to their normal anatomical relationships.
6. If these facts are kept in mind, we shall have gone far in arriving at a solution of this troublesome problem.

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In the overwhelming majority of cases laceration of the genital canal are due to childbirth, but other forms of trauma, such as coitus, attempted rape, or external violence may at times be responsible. The cervix and perineum are the usual seats of lacerations of the obstetrical type.

From "Textbook of Gynecology" by Emil Novak (The Williams and Wilkins Company).

ESSENTIAL HYPERTENSION

AN EXAMINATION OF ITS MECHANISM IN RELATION TO SURGICAL TREATMENT

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DURING the last fifteen years increasing prominence has been given to the problem of hypertension and the relief of this condition by surgical measures. A study of the literature reveals some uncertainty of opinion both with regard to the clinical syndrome and its relationship to renal and adrenosympathetic pathology. It is the objective of this paper to endeavor to correlate the clinical types, which the hypertensive condition presents, with the knowledge derived from the very considerable experimental research work that has been carried out, and upon this basis, to attempt an evaluation of the position of surgical treatment. Essential hypertension is associated with two broad physiopathological features. First, tissue change in the vascular system particularly in the renal vessels, and secondly, an instability of the balance of the adrenosympathetic neurochemical apparatus.

The importance of renal ischemia and associated fall of renal pulse pressure has been shown to be fundamental in the etiology of at least one type of hypertension. This introduces a primary factor in the solution of the mechanism involved, namely, the causation of the hyperplastic and degenerative changes in the cells composing the walls of the blood vessels.

Much of the experimental work carried out in recent years, both in America and Europe, on the production of hypertension in the laboratory animal must be linked with the earlier investigations upon the production of vascular tissue change. Prior to the onset of cardiovascular damage, the increased pressure is principally dependent upon the rise of the peripheral resistance to the blood flow, cardiac output and viscosity of the circulating blood being unaltered pressure factors. The problem is therefore narrowed to the cardinal issue as to the causation of the increased resistance of the arterioles, whether transient and paroxysmal, or permanent and progressive to the point of lumenal blockage.

In 1897, Cehanovic reported connective tissue cell hyperplasia and nuclear changes in the muscle cells of the tunica media of blood vessels after severance of their sympathetic innervation. About the same time, von Bechterew concluded that the effect of sympathectomy on the blood vessels was an increase of elastic tissue both in the intima and the media accompanied by muscle cell hyperplasia. This work was followed up by Lapinski in 1908. He examined the arteries of the rabbit's ear after division of the cervical sympathetic supply and found that out of a series of fourteen animals, seven showed rapidly atrophy of the medial muscle cells at focal points, in others there was hypertrophy of these cells, while many of the animals exhibited hyperplasia of the intima.

The next development of the problem came from the work of Manouèlian in 1913. He showed that atheroma of the abdominal aorta in dogs was the sequel to the division of a specially selected and fairly constant sympathetic fiber which entered the vessel near the origin of the left renal artery.

About this same period, the investigations of Todd and Stopford demonstrated that the pressure of a cervical rib or associated fibrous bands upon the sympathetic fibers lying in the lowest brachial cord

was followed by a precisely similar series of degenerative changes in the arteries distal to the pressure. It was specially observed that the endothelium of the intima showed considerable proliferation along with the increase of elastic tissue, the muscle cells of the media were also hyperplastic.

During the World War I, the researches of Stopford on cases of peripheral nerve injury showed that tissue change of a similar type occurred in the distal blood vessels of those limbs subjected to irritative lesions of their peripheral nerves.

Retrogressing to an earlier observation made by Pearce in 1906, he discovered that the injection of fractional doses of adrenalin produced in rabbits the same series of vascular tissue changes found to follow division of their sympathetic innervation. These changes were comparable to those following neural irritation in the human subject. Confirmation of this observation was obtained in 1920 by Polettini at Turin.

In 1924, I took up the investigation and starting from the hypothesis that proliferative and subsequently degenerative cell reaction in the walls of blood vessels is due to irritation or section of their nerve supply, I decided to produce chronic fibrotic irritation of the sympathetic nerves and study the effect on the blood vessels within their area of distribution. Repeating the earlier work of Pearce and Polettini, I was not successful in obtaining similar results from adrenalin injections, but in a series of animals subjected to daily electric stimulation of the cervical sympathetic in addition to adrenalin injections, there was definite evidence of tissue change as compared with the controls. Degeneration of the muscle cells of the media with fatty deposition in focal necrotic areas was combined with proliferation of both the intimal endothelium and of the elastica, which had become fragmentary. The excitation of chronic fibrosis by means of submerged skin tubes sutured around the cardio-aortic nerve supply produced, in a high percentage of the animals, changes both in the intima and the media of a similar nature. The completion of the evidence linking vascular cell balance with the adrenosympathetic system came from the work of Nicolo Maggi and Ernest Mazochi in 1933. They grafted adrenals in rabbits and succeeded in obtaining the same graded series of arterial tissue change. Their results were confirmed by Leriche's pupil, Froehlich,[1] who introduced adrenal grafts beneath the skin of rabbits at four-day intervals. The number of grafts was graded, as many as forty being inserted in some animals, and in all of them progressive arterial change was found comparable to that following neural irritation. It was concluded that the increased adrenalin produced leading to abnormal stimulation of the vasopressor mechanism of the blood vessels was the basic cause for the changes observed.

Thus far, investigations had shown that frequently repeated injection of adrenalin or multiple adrenal grafts produced hyperplasia and degeneration in the blood vessels. These changes can also be elicited by irritation of the sympathetic nerve supply to blood vessels or by section of specially selected sympathetic filaments. The earliest phase of this cell reaction is one of hyperplasia affecting the smooth muscle cells of the media, followed by increase of the elastic fibers and proliferation of the intimal endothelium.

The next stage in the solution of the problem is the study of experimentally produced hypertension in animals. Three main types of procedure may be considered: First, hypertension can be created by operative measures affecting the renal circulation, either by clamping the renal arteries with Goldblatt's clamp or ligation of some of the vessels in the renal pedicle. Again it can be produced by bilateral subtotal nephrectomy. All of these methods produce a swift rise of blood pressure which is sustained and not paroxysmal in type, and after the initial gain there is a steady increase of the hypertension and deteriora-

tion of the animal. Second, operative intervention upon the carotid sinus with the division of the vasodepressor nerves will also produce a sustained rise of blood pressure. Third, hypertension may be produced by the injection of substances such as Kaolin into the cisterna magna.

The greatest interest and controversy has ranged around the first experimental method, the renal ischemic hypertension. Evidence for and against the adrenal glands playing a rôle in its production has been advanced by several American teams of research workers. Long ago, Tigerstedt and Bergmann isolated from the renal parenchyma a vasopressor substance which they called Renin. It had affinities to adrenalin and recent work has shown that renin and another vasopressor substance physiologically allied to it are both formed by the renal tissue, especially when this has been damaged through alteration of its blood supply.

Goldblatt has proved that if the condition of renal hypertension is produced by his arterial clamp it does not develop if bilateral adrenalectomy has been performed, despite the fact that the animals are kept in good condition by the administration of salts and a non-pressor cortical extract. This observation has been confirmed by some and denied by others. Collins and Wood found that experimental renal hypertension developed even when the kidney was isolated, showing that the nerve supply of the organ was not concerned in the production of the phenomenon. They found that unilateral adrenalectomy after the production of Goldblatt ischemia, produced a fall in blood pressure and if the other adrenal was excised there was a still further fall of the blood pressure, despite a still further constriction of the renal vessels. If, on the other hand, adrenalectomy was carried out as the primary procedure and followed by the production of renal ischemia, the blood pressure was found to increase but the rise was not well maintained.

In 1939, Diaz and Levy produced hypertension in rats by a subtotal resection of five-sixths of each kidney in two stages Twenty-three animals survived the operations and all showed a progressive rise of pressure from 110/60 at the outset to 235/150 at the end of ninety-four days. They carried out bilateral adrenalectomy and after an interval of two to seven days, the blood pressure of these animals fell 67 mm. Hg. and later a further 54 mm. Hg. but remained higher than before the partial nephrectomies. Histologically, the kidneys showed focal tubular damage and glomerulonephritis, while the adrenals presented evidence of *medullary hyperplasia.* A vacuolytic zone had developed between the cortex and the medulla and the former was relatively thin.

It is of great interest to compare the results of these investigations with those of Introzzi of Buenos Aires, published in 1938. He produced renal ischemic hypertension in a series of dogs and found that the control group all developed a progressive rise of blood pressure with retinal changes.

In another series, he divided the sympathetic innervation to both adrenals, prior to clamping the renal artery. In this group all the animals developed renal hypertension, despite the sympathectomies. In a third group, after having carried out the renal procedure, he resected half one adrenal gland and in addition performed lumbar ganglionectomy and division of the splanchnic nerves on the same side. In one series of experiments, these operations were performed on both sides. In those animals in which the bilateral procedure had been performed, the renal hypertension was completely counteracted, blood pressure fell to normal or nearly normal levels. On the other hand, unilateral subtotal adrenalectomy, combined with sympathectomy, caused only a slight fall in blood pressure from the hypertensive level and that only transitory.

Introzzi concluded that the hypertension produced by substances in the damaged kidney was dependent on adrenal integrity

and the production of sufficient adrenalin to maintain the blood vessels in a responsive state. His further work has shown that experiments on animals with hypertension from renal ischemia must be made while the hypertension is constant and moderate. If the arterial obstruction of the kidney is too great, renal insufficiency vitiates the results.

The failure of sympathectomy to relieve experimental hypertension in dogs has been demonstrated by the work of Alpert, Alving and Grimson who divided the right and left splanchnics and resected the four lower dorsal ganglia and obtained only a temporary decline of blood pressure. In America, Page has also confirmed that bilateral adrenalectomy after the production of renal ischemia, causes a fairly rapid subsidence of the hypertension, even despite the fact the animals can be maintained in condition by the daily administration of cortical extract and salts. Furthermore, if the bilateral resection of the adrenals is performed before the application of the renal clamps, no rise of blood pressure occurs. On the other hand, if the adrenal medulae are carefully destroyed, leaving the cortices functionally intact, the development of hypertension from the application of the Goldblatt clamps ensues without difficulty.

More recently, Friedmann, Somkim and Oppenheimer found that the concentration of renin in the kidneys of cats was not reduced by adrenalectomy. They also confirmed Page's observation that bilateral adrenalectomy gradually reduced the response to vasopressor substances such as renin and this sensitivity was only partially restored by administration of cortical hormones. They concluded that the renin of Tigerstedt is the cause of hypertension following renal injury and that its action is directly related to some substance excreted by the adrenal cortex.

The Second Method for the production of experimental hypertension consists in the division, in rabbits, of the cardio-aortic nerves as close as possible to the thoracic cage with suture of their central ends into the sternomastoid muscles. This is combined with division of the nerve fibers between the superior cervical ganglia and the carotid arteries with ligation and division of the interna. After fourteen days the blood pressure rises from 140 to 200 mm. Hg. Hypertension was investigated on these lines by Introzzi, and Leriche, Fontaine and Froehlich.

They found that unilateral adrenalectomy had no effect upon this type of hypertension while a resection of a moiety of the remaining adrenal caused a drop in blood pressure from 210 to 140 in one animal and in another from 220 to 100, but after twenty-seven days the pressure always returned to the previous high level. Further work of Fontaine confirmed this. It should be noted that these investigators left a fraction of adrenal tissue, which was not done in the case of the American workers. Further, it is well known that sympathetic denervation is followed by increased sensitivity to adrenergic substances circulating in the blood stream. This factor combined with a portion of normally functioning adrenal would account for the failure to maintain the fall of blood pressure.

Thirdly, experimental hypertension produced by the intracisternal injection of kaolin has been studied by Jeffers, Lindauer and Lukern. If hypertension is produced by this means, bilateral denervation of the adrenals is without effect, but bilateral adrenalectomy is followed by a definite hypotensive phase. If cortical extract is administered, there is a return to the previous hypertensive level.

In view of the fact that a non-pressor extract of the adrenal cortex plus salts is sufficient for this recovery to take place, these workers concluded that the adrenal cortex is the essential portion of the gland for the development of experimental hypertension.

These lines of investigation have shown that the following factors are operative in connection with the hypertensive state:

(1) A vasopressor substance excreted by the renal parenchyma, which is allied to adrenalin, appears to be capable of producing hypertension only in the presence of another factor dependent on the cells of the adrenal cortex. This latter substance appears to be associated with the maintenance of the normal sensitivity of the peripheral vasomotor apparatus to adrenergic substances. Thus the removal of the adrenal cortex causes a gradual failure of the renin response due to a progressive threshold change in the cells of the blood vessels. Therefore, bilateral adrenalectomy counteracts renal ischemic hypertension, but bilateral destruction of the adrenal medullae permits the development of this condition. (2) The removal of the nerve supply to the adrenal bodies does not materially effect any of the types of hypertension experimentally produced, beyond a transitory fall.

At this stage, it is important to emphasize the caution so often advanced by Leriche, that all these forms of hypertension produced in the laboratory animal are foreign to the essential hypertensions in the human subject. They provide us with only a clue to the relationship between the adrenals, the kidneys and the sympathetic innervation, but the difference between the experimental conditions and the clinical entity must be kept in mind.

Pressor substances could not be demonstrated in increased amounts in the blood of hypertensive patients and the dictum was laid down by some physiologists that under no circumstances was surgical intervention on the adrenals justifiable, there being no evidence to link hypertension with the increased production of a hormone of the adrenalin type. However, Leriche assayed the adrenalin content of the suprarenal glands which he had excised from cases of essential hypertension and found that they contained a much greater quantity of adrenalin than the normal gland. More recently it has been shown that the pheochromocytomas are associated with epinephrine crises, accompanied by paroxysmal hypertension. In these cases the tumors yield a very high adrenalin content. Moreover, the slightest manipulation of the tumors during operation produces a rapid rise of blood pressure, or conversely a dramatic fall on ligation of the adrenal blood vessels.

It is in this connection we must bear in mind the chemical transmission of the sympathetic nerve impulse both through the ganglionic synapses from the preganglionic fibers to the ganglion cells and from the post-ganglionic fibers to the effector apparatus at their distal extremities. The liberation of acetylcholine in the ganglia and an adrenalin-like substance around the effector terminals consequent upon the passage of the nerve impulse provides us with a chemical process linking up the peripheral reactions associated with paroxysmal hypertension with the increased adrenalin content of the suprarenal glands in those cases which exhibit hypertensive symptoms.

Lastly, in association with the experimental aspects of hypertension, we must recall the important work of N. K. Koltsov and M. L. Rochlin, in Moscow, upon the rôle of ions and hormones in the process of stimulation of effector organs. These investigators demonstrated that ionizable salt solutions have a direct synergic action on the effector mechanism of isolated blood vessels. Rochlin inferred that the response was due to a change of ionic concentration resulting in alteration of surface tension at the cell membrane. The cortex of the adrenal bodies has been shown to be intimately concerned in the metabolism of salts, the removal of the adrenals rendering imperative for life the administration of salts such as sodium chloride and sodium citrate. Therefore, abnormal action of the adrenals might lead not only to the increased production of adrenalin and of cortical substances complimentary for the pressor reaction of renin but in addition excite a disturbance

of the salt balance leading to increased sensitivity of the effector organs in the blood vessels to certain ionizable salts.

These influences would affect the vascular system in two ways: First, they would stimulate the local ganglionic network of the autonomic system in the wall of the vascular tube and, second, the sympathetic connections with the central nervous system. In the latter association we must not lose sight of the fact that both cholinergic and adrenergic phenomena are associated with the passage of the sympathetic nerve impulse from the central nervous system to the periphery and that adrenalin in high dilution shows reversible action.

Thus in cases of imbalance of the adrenosympathetic apparatus we have a mechanism which once disrupted must lead directly to physiochemical changes in and around the cells of the effector mechanism in the media of the blood vessels. This in turn initiates a series of tissue changes which have been shown to follow chronic irritation of post-ganglionic sympathetic fibers or to hyperadrenalism, changes which in their early phase of muscle cell hyperplasia might lead to greatly increased sensitivity to pressor stimuli and therefore excessive physiological response. The fragmentation of elastica, intimal proliferation and degeneration of the media would lead to the development later of a fixed peripheral resistance and permanent hypertension.

In other words, in its earliest stages, hypertension associated with an adrenal factor would be intermittent, but later, vascular tissue change would produce permanent fixity of peripheral resistance with consequent persistent and progressive rise of blood pressure with the progress of the lesion.

A consideration of the renal factor connected with experimental ischemia of the kidneys must be deferred until the evidence of the clinical aspect has been discussed.

CLINICAL SYNDROME IN ESSENTIAL HYPERTENSION AND THE MECHANISM INVOLVED

The literature from many countries provides adequate materials to form a judgment on the different clinical types presented by the hypertensive syndrome.

American surgeons, such as Adson, Craig and deCourcy, have had the advantage of operating on a large number of these patients. Craig, in 1937, classified the hypertensions into two groups, primary and secondary, and with regard to the first named he mentions four types: (1) Those in whom the rise of blood pressure is slight and returns to normal on resting. In these cases the retinal vessels show slight sclerosis. (2) Moderate hypertension with moderate sclerosis; (3) severe hypertension accompanied by angiospastic retinitis; and (4) severe hypertension with edema of the optic discs.

This classification, based on the degree of clinical severity, is not sufficiently comprehensive to cover the fundamental differences shown in a large series of cases of primary hypertension. The outstanding types are: (1) Those cases in which the clinical course is characterised by paroxysmal crises associated with great rise of blood pressure from a base slightly or moderately above the normal level. This type may be associated with tumor formation in the adrenal gland, such as the pheochromocytomas, or may occur in the absence of neoplastic pathology. (2) Cases in which there is sustained hypertension gradually rising to higher levels. In this type, progressive cardiovascular changes are always found and therefore the graded retinal signs which form the basis of Craig's classification also occur. Type two is invariably connected with tissue change in the renal blood vessels. It may be termed the *Plateau Type* of hypertension. (3) The third type of primary hypertension is one in which the paroxysmal crises are superimposed on steadily progressive hypertension of the plateau type.

This classification is no mere segregation of clinical material on empirical lines according to signs and symptoms, but is dependent on a basic difference in the physiopathological mechanism involved.

The paroxysmal hypertensions forming Type One will be first discussed.

Before considering the mechanism underlying the clinical syndrome in cases of this type, I will give the details of a case which came under my own care, which demonstrates certain basic principles relative to the mechanism involved:

A woman, aged forty-seven in 1938, was referred to me by Dr. Unger of Blackpool, in June of that year. She had a history of paroxysmal hypertensive crises extending over a period of fourteen years, gradually increasing in severity while recurring at shorter intervals The attacks were characterized by the following signs and symptoms: Pain felt over the left thorax spreading to the axilla and inner side of the left arm; severe palpitation, the pulse rate rising to 200 per minute; pain radiating from the left side of the forehead and gradually involving the whole head; profuse sweating, particularly of the palms of the hands and the trunk; nausea and retching and occasionally vomiting and rise of blood pressure from 130/80 to 182/90. Between the attacks she showed signs of great muscular weakness, each attack leaving her increasingly exhausted, to such an extent that she had to be helped when moving from a chair or walking a short distance. There was nearly constant precordial pain, stiffness of the muscles of the back and neck, and dull frontal headache, persisting from one crisis to another. These attacks came on almost daily, occurring chiefly on rising from bed or in attempting to walk, and lasted from a few minutes to some hours. The slightest effort produced a rise in pulse rate of 30 or more per minute.

On examination there was no sign of cardiac enlargement; heart sounds were loud and bumping; there were no murmurs; the pulse was of very small volume, owing to the marked contraction of the radial arteries.

No abnormal changes were visible in the fundi; lungs and central nervous system were normal. The urine showed the presence of albumen and was cloudy; there was no sugar present. The thyroid was not enlarged and there were no signs of exophthalmus. There was no hepatic or splenic enlargement in the abdomen but slight tenderness over the left costovertebral angle. The hands and feet were cold, clammy and slightly bluish. The muscles were atrophic. The blood count showed hemoglobin 90 per cent; red cells 5.0; color index 0.9; white cells 4.0; no abnormal forms were present.

An excretory pyelogram showed no abnormality of the kidneys. *X*-ray of the lung fields showed no clinical evidence of pulmonary disorder. The electrocardiogram showed a simple tachycardia. The basal metabolic rate was plus 2 per cent; blood urea 22 mg. per cent; blood calcium 11.6 mg. per cent; blood chlorides 450 mg. per cent. The Wassermann reaction was negative.

Dr. Unger saw her again on August 28, 1938, and gave her an injection of 10 mm. of adrenalin in two equal doses at an interval of about eight minutes. The pulse rate before the first injection was 76, the blood pressure 135/80. The patient took the injections without the slightest upset and during the next seven minutes had no untoward symptoms. After the second dose she continued talking calmly for a minute or two, then showed sudden signs of unrest and called out that an attack was coming on. The pulse rate was now 146, the radial arteries contracted, the heart beating violently with forcible contractions. The blood pressure rose to 190/90 with visible blanching of her cheeks. There was considerable pain and throbbing in the chest and head. The reaction continued for about twenty minutes and gradually subsided. The patient was very exhausted. She then suddenly complained of intense occipital headache and forty minutes after the first injection shouted out that she had a severe pain in her back which was accompanied by contraction of the spinal muscles and acute tenderness over the costovertebral angle on the left side.

A blood sugar taken before the adrenalin injection was 100 mg. per cent and an hour afterwards had risen to 177 mg. per cent. The blood pressure was now 140/80 and the pulse rate 112.

I carried out a left adrenalectomy on September 18, 1938, excising a gland weighing 4.1 Gm. which showed no abnormal histological feature. After an uneventful con-

valescence the patient was discharged home on October 28, 1938, since which date to the present time (over six years later) she has had no repetition of the hypertensive crises. Her blood pressure has remained more or less constant at 145/90. Following her operation she steadily regained weight and strength and has been able to live a normal life.

It will be noticed that the paroxysmal attacks in this patient could be excited by the injection of adrenalin. In this respect, as well as in the clinical syndrome, a close comparison may be made with a case of paroxysmal visceral crises which I investigated some years ago.

The subject was a tabetic who had undergone posterior rhizotomy by the late Sir William Thorburn. Injection of adrenalin produced violent crises accompanied by hypertension, tachycardia, sweating and rigidity of the spinal muscles, all of which symptoms were relieved by nitrites.

Investigation of the nature of the afferent sensory pathway in cases of hypertensive crises associated with tabes showed that extensive posterior root section left a vague deep sensitivity of the muscles within the area of cutaneous anesthesia. Similar observations were made by Walter Lehmann, of Göttingen, Föester, at Brëslau, and others. It was noticed that the lightning pains were cured by posterior radiocotomies, whereas on the other hand, persistence of deep sensation was associated with a recurrence of crises in which pain of a griping character was referred by the patient as being felt deep within the abdomen. Tabetic crises treated by both anterior and posterior root section were free from these recurrent symptoms. It was suggested that pain crises of this type are due to irritation of the sympathetic fibers and the sensory phenomena are dependent upon axons traversing the anterior spinal roots and associated with the end organs of Agdhr in the striated muscles. A series of experiments were carried out on animals which appeared to confirm this view.

If paroxysmal hypertensive crises are due to sympathetic imbalance, it follows that there is either an excessive production of vasopressor substances or there is a change in the threshold required to elicit normal responses in the vasomotor apparatus within the walls of the peripheral vessels, or both factors are concurrent. In this association, the cold pressor test is of great importance; if the hand is immersed in ice-cold water at 4°c. for a few minutes, the blood pressure is found to rise rapidly to a high level in the true hypertensive case, but the response in the normal person is always of a low grade, showing that there is an increased susceptibility of the vasopressor mechanism to surface stimuli in the hypertensive individual. A series of experiments on variations of the pressure-pain threshold in the human subject throw some light in connection with this problem.

I found that moderately strong Faradic stimulation of a mixed peripheral nerve such as the median, produced a fall in the threshold for pressure pain and this appeared to affect the cutaneous receptors more than those of the deep tissues, and it was found to occur independently of vascular change, proving that physiological change around the receptor occasioned by the electrical stimulus altered the threshold for the perception of pressure pain. Moreover, in those experiments in which the peripheral circulation was released, this degree of electrical stimulus was accompanied by sweating and vasoconstriction. It is suggested that in the paroxysmal hypertensions there is a cyclical lowering of the threshold values such that stimuli of a lower degree excite pressor responses and the reaction to stimuli of normal quality is so exaggerated that a critical phase results. The constant repetition of such phases may result in the facilitation and induction of the synaptic junctions involved.

The work of Youmans and his collaborators at Portland, Oregon, has demonstrated the biochemical processes involved

in these rapid clinical reactions. They have shown that the injection of acetylcholine is followed by a reflex liberation of adrenergic substances. This occurs within a few seconds of the injection of acetylocholine and originates both from the adrenals and from the adrenergic nerve endings, because the isolated intestine of the de-medullated animal still shows the inhibitory phase of adrenergic excitation. That it comes from the adrenergic sympathetic endings was shown by the absence of intestinal inhibition after removal of the celiac ganglia. Such initial vasodepressor action might be due either to aberrant stimuli from the higher centers of the central nervous system or to biochemical imbalance, and this is followed instantly by the reflex liberation of adrenalin from the adrenalin medullae and the adrenergic endings of the sympathetic. The latter with their associated motor mechanism have either an abnormally low threshold produced by biochemical change or inherited tendency, which results in a rapid critical response to the chemical reflex and excites the full clinical syndrome which we classify as paroxymal hypertension.

The lowering of the threshold for stimuli productive of vasomotor contraction is also shown by the observation that the pheochromocytomas of the adrenal glands, proved to contain a large quantity of adrenalin, may, or may not, be attended by crises of paroxysmal hypertension, showing that an additional factor must be present besides the increased quantity of adrenalin, which determines the recurrent critical phenomena. Such a factor may well be linked with the depressor substance acetylcholine and the adrenergic reflex.

The *Second Type of Primary Hypertension*, the *plateau* variety, is characterized by a rise of blood pressure which is steadily maintained at a high level and tends to show a progressive rise as the physical position deteriorates. This variety occurs in two distinct groups: (1) The largest group is common to the fourth and fifth decades of life and often associated with the menopause in women. (2) A very small and clinically select proportion is associated with chronic atrophic pyelonephritis and may arise early in life.

The common type, linked with menopausal changes, may be due, as suggested by de Courcy, to the failure of the balance in the metabolism of fibrous tissue. The activity of the adrenals at a period of life when the gonads decay, results in a replacement of tensile tissue such as muscle and elastica by fibrotic depositions. These cases are related to the tissue changes within the walls of the blood vessels. A pathological process similar to that evoked by sympathetic nerve irritation might give rise to disorganization of the vascular supply to the renal tissue, resulting in damage to the cells of the renal parenchyma and would be followed by the liberation of renin and the initiation of the renal type of hypertension.

Page believes that renin is released by the kidneys when their pulse pressure is reduced. Renin is thought to combine with a pseudoglobulin in the blood to form angiotonin which has been isolated and identified as a pressor substance producing hypertension by its action on the arteries. Other investigators consider that renin is an enzyme which acts on its globulin substrate to form a pressor substance Hypertensin identified with Angiotonin, the whole process being counteracted through another enzyme Hypertensinase which breaks down the pressor combination in the blood and tissues. These substances produce their vasoconstrictor action only in the presence of some complementary factor excreted by the cortex of the adrenal gland.

Another theory advanced by Holtz to explain the renal hypertensions, suggests that the kidneys contain the enzymes decarboxylase and amine oxidase, and the latter acts only in the presence of oxygen. During ischemia, the oxygen supply is reduced and whilst decarboxyla-

tion of amino acides continues, deamination is incomplete, therefore amines form, many of which are pressor in action, especially the phenolic compounds, and these in the presence of a labile vasomotor apparatus due to adrenal activity, produce the hypertensive syndrome.

Many of these cases of hypertension are associated with hyperplastic changes in the adrenal glands resulting in a vicious circle, productive of vasopressor substances.

Clinically, all these cases of plateau hypertension show progressive physical degeneration with the gradual retinal changes mentioned by Craig. In consequence of tissue change in the blood vessels being a basic factor of their pathology, there is progressive cardiovascular and renal disturbance toward complete failure and death.

The second and smaller group of the plateau hypertensions is associated with chronic atrophic pyelonephritis. The incidence of this type of hypertension may be judged from the observation of facts reported by William F. Braasch at the Mayo Clinic. Here 4,000 cases of hypertension were seen in one year. Of this number, only 100 or 2.5 per cent presented non-nephritic renal lesions and of these, merely nineteen or .5 per cent were selected for operative treatment; in the remaining eighty-one cases, the renal lesion appeared to be co-incident and not related to the hypertension. Thus, of this large series of cases, only a fraction of 1 per cent were suitable for surgical treatment by nephrectomy.

Further research work has shown that hypertension occurred in 20.3 per cent of 793 cases of renal stone, but perinephritis was not associated with hypertension.

The problem arises as to why only a small percentage of cases out of a large series all showing essentially the same type of damage to the kidney substance, develop the hypertensive syndrome. Comparison is suggested with the incidence of paroxysmal hypertension in the pheochromocytomas. Once again a further factor toward the initiation of the pressor response is indicated and in this case the change probably concerns the adrenal cortices and therefore the subtotal resection of the adrenal glands and in some cases a unilateral adrenalectomy is as efficacious in reducing the hypertension as the resection of a kidney showing changes of chronic atrophic pyelonephritis.

The Third Clinical Group presented by the *Primary Hypertensions* is one in which the features of the two preceding types are combined. These cases show a sustained hypertension with paroxysmal attacks superimposed. The latter are often the earliest feature in the development of the condition, while only gradually is the general level of the blood pressure fixed at higher values between the crises until ultimately the fully developed plateau hypertension ensues with the progressive cardiovascular degenerative changes. It is a surprising fact that many of the paroxysmal cases remain free of all signs of sustained hypertension over periods amounting to years, as in the case I have recorded in this paper, while in other instances Type 1 merges with Type 2 after a relatively short interval. The clinical pitfalls in this type are exemplified by the following case under my care:

An asylum attendant, aged thirty, was admitted to my wards complaining of severe griping abdominal pain referred to the left flank and transumbilical regions. There was a history of complete constipation with bowel action at intervals of seven days or more; there was slight distention of the abdomen and attacks of vomiting. Urine excretion was normal. The patient was pale and sweating from pain. In view of a previous appendicectomy scar and the critical nature of his symptoms, a laparotomy was carried out on the mistaken diagnosis of a possible intestinal obstruction. No abnormality was found within the abdominal cavity. The patient died within forty-eight hours from a dramatically sudden epinephrine crisis with a blood pressure of over 300. Postmortem examination showed hypertrophy of the medullae and cortices of both adrenal glands with marked cardiovascular and renal

changes. In this young man's case there was evidence from his doctor that he had suffered from what we know to have been hypertensive crises accompanied by vomiting and abdominal pain for two or three years prior to his death, with marked over-action of the sympathetic, producing intestinal inhibition. The advanced cardiac changes could be associated only with long-standing and persistent hypertension.

The physiopathological mechanism of this third clinical group is clearly indicated from the findings in this case, both factors renal and adrenal are operative and in the latter instance the cortex and medulla of each gland contributed their quota to the production of the symptom complex. The renal changes result in renin liberation which in the presence of substances produced by the adrenal cortices caused the sustained pressor response whilst the paroxysmal crises followed on hyperadrenalin excretion by the hypertrophied adrenal medullae in combination possible with a nerve factor associated with the liberation of acetylcholine. It is interesting to find that this man had shown marked pyschological depression during the last two or three years preceding his final illness.

RELIEF OF HYPERTENSION BY SURGICAL MEASURES

The surgical relief of the several types of hypertension must be considered in relation to each of these.

Paroxysmal Hypertensions. In this group, associated with or without the presence of neoplasm of the adrenal glands, the question of surgical relief must be considered. In those cases in which a pheochromocytoma has been diagnosed, such intervention is imperative; but for all those cases not connected with tumor development, in which medical measures have failed to give relief, surgery has an undoubted place in the treatment. The uninterrupted clinical course of this disease shows progressive physical deterioration in the patient, leading to total social incapacity, and from permanent renal and cardiovascular damage, to early death.

The reports on the operative results on hypertension attained by surgeons of many different countries, show quite definitely that all the symptoms associated with the critical phase can be relieved by operative treatment. The palpitation, heart-consciousness, headaches, thoracic and spinal pains, sweating, tinnitus and physical exhaustion are relieved by surgical procedure, despite the fact that in many cases the blood pressure is not restored to normal levels. This is a most important practical point which has lead to much confusion in assessing the results of surgery. Some workers in reporting their cases are dominated with the sole conception that the hypertension is alone the necessary factor for elimination. Leriche has many times stressed the point that the material improvement from the patient's standpoint is centered around the abolition of the whole symptom complex which cannot be measured in millimeters of mercury. The latter is only one side of the complicated sequence of events and a very moderate subsidence of the hypertension may be accompanied by really dramatic relief to the patient from the whole train of symptoms. In attacking the paroxysmal hypertensions by surgery, we have three general lines of precedure: (1) Denervation of one or both adrenal glands; (2) resection of one adrenal or subtotal resection of both adrenals, and (3) denervation combined with subtotal resection.

Before citing the results of surgery in these several methods, we must recall certain factors which are of the utmost importance in connection with the line of surgical approach. In the first place division of the post-ganglionic fibers or removal of the paraspinal ganglia from which they arise, leads to a progressive lowering of the threshold in the peripheral vascular receptors to circulating adrenergic substances, so much so that the animal sensitized by sympathecomy forms the best method of testing for the presence of such hormonal substances. This sensitivity gradually appears after sympathectomy, attaining a maximum development about a month following the operation and may persist indefinitely.

In the second place, division of the pre-ganglionic sympathetic fibers, although it leads to a similar sensitization of the distal vascular mechanism, does not produce anything like similar degree of hypersensitisation. The position of the cells of the adrenal medulla, since they are derived from the embryonic ganglionic crest like those of the sympathetic ganglia, is one of similar relationship to these ganglion cells, that is to say, the nerve fibers reaching the adrenal medulla via the splanchnics in the thoraco-lumbar outflow from the sixth dorsal to the second lumbar roots, are pre-ganglionic fibers. Divisions of the splanchnic will thus be a division of pre-ganglionic fibers so far as the adrenal medullae are concerned, but on the other hand there are many other fibers passing through the splanchnics to a peripheral distribution that have already come from cell stations in the paraspinal ganglia near the origin of these nerves. Division of such axons will consequently produce similar results to the section of post-ganglionic sympathetic fibers.

Bearing these observations in mind, we may turn to practical results of surgery. Adson and his collaborators in America, first carried out very extensive ventral rhizotomies of all the roots from the sixth dorsal to the second lumbar on both sides. Adson reported excellent results. Unfortunately the hypertensions so treated were of mixed types but he stresses the fact that this procedure abolished the hypertensive crises with the accompanying cardiac consciousness, precordial pain, cephalgia, spasm of the retinal arteries, while the cold pressor test showed a lower level of reaction and papilledema subsided. There was also a curious water lag during the day followed by polyuria during the night after the operation.

The severity of the operation can be judged by the number of roots that would have to be exposed and therefore Adson and Craig altered their technic to a bilateral division of the splanchnic nerves below the diaphragm, combined with section of the white rami of the first and second lumbar nerves. By this method they obtained equally good results comparable with those obtained from extensive root section and they stressed the fact that the best results are those in patients below the age of forty.

As regards the hypertension itself, they record falls of systolic pressure immediately after operation from 270 to 100 and of diastolic pressure from 170 to 60. The pressures tend to rise slowly during the patient's convalescence until average pressures of 160 to 120 systolic and 110 to 90 diastolic are attained a month or so after the denervation, but as in the patients treated by rhizotomy, all the critical symptoms subside.

The future history of these cases shows degrees of instability. In some patients certain symptoms return after a year or two, but there is no doubt that permanent benefit is achieved by the bilateral operation. There are certain complications. There is a failure of ejaculation leading to sterility in the male, although there does not appear to be any interference with micturition or defecation; nor in the female is there any interference with menstruation or pregnancy.

This method of treatment may fail in some cases on account of the sensitization of the peripheral receptor apparatus to adrenergic substances in the blood stream and therefore the second line of attack by removal of the adrenal gland on one side, or bilateral subtotal resection must be considered.

Oppel who had experience of large numbers of cases of juvenile arteritis and arterial crises attributed their pathological cause to adrenal dysfunction consequent upon great stress and strain during the period of the Russian revolution, when such cases became exceptionally common. He treated many patients by adrenalectomy and although at the time some workers did not credit his results, subsequent investigation has shown that he obtained a very high measure of success, often among very poor circumstances. The

practice of adrenalectomy for paroxysmal hypertension has proved that the unilateral operation will completely abolish the critical syndrome and I have mentioned a case in which there has not been a single recurrence of the symptom complex from the time of operation over six years ago. Unilateral adrenalectomy cannot obtain its results by the simple abolition of an excessive secretion of adrenalin *per se*, because we must presume equally good function in the remaining gland. Its effect must be exerted upon the threshold level for stimuli in the peripheral vasomotor apparatus of the blood vessels. In the case I have recorded there was no histological abnormality of the gland, and Leriche and his school have particularly stressed this point that some of the glands excised show no pathological changes and yet the clinical condition of the patient is cured or very greatly relieved.

Unilateral resection of the adrenal also avoids the danger of sensitization of the peripheral effectors that we have seen to follow post-ganglionic sympathectomy and also there is an absence of the urogenital complications.

Bilateral subtotal resection of the adrenal glands is an operation that may introduce a dangerous complicating factor. In the first place it is difficult to be sure that the functioning tissue left has not been damaged, either by ligation of vessels or from secondary edema accompanying traumatic reaction, and secondly, insufficient tissue may be resected. A number of cases have been reported in which death from adrenal failure has followed this method, and therefore the third procedure, a combination of adrenalectomy and sympathetic denervation would seem preferable. This procedure should be undertaken in two stages, which permits the surgeon to estimate the degree of improvement before submitting the patient to the further surgical risk of operation upon the remaining gland. The primary procedure should be one of unilateral adrenalectomy without splanchnic division. In the majority of paroxysmal cases the operation is sufficient; but if there is a relapse of certain symptoms, the sympathetic denervation of the remaining gland may be carried out after an interval of at least several months in order to permit the patient to stabilize following the first operation. In connection with the second procedure, it must be borne in mind that cases have been reported of sudden necrosis of the gland following denervation, although operative trauma may have something to do with them.

The surgical treatment of those patients who exhibit the plateau type of hypertension falls naturally under two procedures: (1) Nephrectomy for the small group of cases in which the lesion is directly connected with the presence of a unilateral chronic atrophic pyelonephritic kidney and (2) adrenalectomy, where there is no evidence of a primary renal lesion associated with the hypertension.

The operative results of nephrectomy for hypertension following chronic atrophic pyelonephritis show complete relief in 70 per cent of the cases, but as previously mentioned, the incidence of this particular type is a mere fraction of the number of cases presenting symptoms of essential hypertension. At the Mayo Clinic during a period of ten years, only forty-three cases of atrophic pyelonephritis were subjected to nephrectomy.

With regard to adrenalectomy in cases of severe malignant hypertension, Eisenberg carried out subtotal adrenalectomy for severe cases of this type. There were two deaths and those that survived showed equivocal results. Craig has emphasized the point that those patients who show cardiovascular damage are no subjects for surgical treatment of hypertension.

Apart from cases showing advanced deterioration, a number of cases in the fifth and sixth decades of life have been subjected either to bilateral sympathetic denervation of the adrenals or to bilateral subtotal adrenalectomy with the very marked improvement of their symptoms. Even unilateral resection has been followed

by good results. In a woman of thirty-five years, showing a sustained hypertension of 120–220 and constant pain over the left renal region, I carried out a left adrenalectomy with a subsequent fall of pressure to 80–120 and complete relief of the pain syndrome since the operation over a year ago.

For these cases of sustained hypertension, bilateral subtotal resection of the adrenals would seem to be the more justifiable procedure on the experimental basis, and one which, in the hand of the American surgeons has given reasonably good results. As compared with sympathectomy of the adrenals the practical observations of Galata are of special interest. He operated on sixteen patients with primary hypertension by the lumbar route, carrying out subtotal adrenalectomy. Of this series, three were completely cured, eleven very considerably improved and two slightly improved. The systolic pressure generally dropped by 60 to 100 mm. Hg. and the subjective improvement was more remarkable still. On the other hand, of the seven patients treated by splanchnectomy, only one could be considered cured, three were slightly improved and three remained unchanged.

Results such as these are clearly to be anticipated in view of the renal-adrenal factor present in all plateau hypertensions; and where a paroxysmal feature is absent, the operative indications are strongly against adrenal sympathectomy.

The *Surgical Treatment* of the *Third Type of Hypertension* must take cognizance of the paramount importance of the critical element in this type of hypertension, for it is during these great rises of blood pressure, associated with all the phenomena of acute epinephrine shock, that death may ensue. We are faced with the danger of the development of these crises, especially during and immediately after operative trauma, and therefore we must be guided toward the minimum and most essential procedure. For this purpose, bilateral operation is quite definitely contraindicated at one sitting, and bilateral sympathectomy is a doubtful procedure. The obvious line of attack is the resection of one adrenal gland. The results of such an operation are well shown in a case reported by Delannoy, Warembourg and Demarez[3] in 1939. In a man aged fifty-six, suffering from plateau hypertension with violent paroxysmal crises, they performed left adrenalectomy. The crises ceased and the blood pressure fell from 320/160 to 180/140 and his general condition was markedly improved. Therefore, in these cases of Type 3 hypertension, the primary procedure should be a unilateral adrenalectomy and if, after an interval of months, there is an appreciable relapse, intervention on the remaining side should be considered. Goldzicher has shown that a quarter of one adrenal can maintain life, thus a subtotal resection of the remaining gland might encroach on the danger line of adrenal insufficiency. Surgery should, therefore, be restricted to splanchnectomy, but we must bear in mind that even this has been followed by adrenal failure.

CONCLUSIONS

Essential hypertension of the paroxysmal type and the symptom complex associated with it, is a condition directly connected with a disturbance of balance between the adrenal gland and the sympathetic mechanism in the walls of the blood vessels. The failure of the adrenals to maintain the normal condition of homeostasis within the body leads in some cases to critical phenomena in which the reflex chemical mechanism based on acetylcholine and the liberation of adrenergic substances plays a vital part, and to this may be linked hereditary and psychological elements.

The recurrence of such cycles of energy explosion sensitizes the whole adrenosympathetic mechanism, producing a lowering of the threshold to pressor stimuli, so that the crises increase in frequency and degree.

These critical phases often begin in the earlier decades of life and may be attacked surgically by either unilateral resection

of one adrenal or by bilateral subtotal adrenalectomy and bilateral splanchnectomy. The balance of evidence is in favor of adrenal gland section as being the more efficient procedure and one which does not lead to urogential complications and sensitization of the peripheral sympathetic. It has been shown that cures of long duration can be achieved by the relatively safe unilateral operation.

As regards the sustained or plateau type of hypertension, there is probably early damage to the renal blood vessels leading to fall of the renal pulse pressure and the formation of the renin type of pressor substances in the renal parenchyma. These in turn stimulate both cortical and medullary changes within the adrenal bodies, as well as producing hypertension themselves, in the presence of a cortical factor.

Thus, there is a vicious cycle which tends toward progressive deterioration from cardiovascular change. In order to break this cycle by surgical measures, bilateral subtotal resection of the adrenals would seem to be the most scientific method and one which, in the hands of different surgeons in various countries, has given a reasonable measure of symptomatic relief, provided cardiovascular damage is not too far advanced.

The best results seem to be obtained in patients under the age of fifty years, although some of the American surgeons mention forty years as the optimal age limit, but there may be some confusion with the paroxysmal type belonging to the earlier decades.

A small fraction of the cases pertaining to this category are directly associated with chronic atrophic pyelonephritis, and for these the correct procedure is nephrectomy which gives excellent results in 70 per cent of the cases.

Lastly, in the third type, in which the critical element is superimposed on the plateau type of hypertension, the adrenal factor is paramount and unilateral adrenalectomy clearly indicated as the primary operation. After a reasonable interval, provided that the symptom complex persists or deteriorates, a denervation of the remaining gland may be considered when the patient has stabilised.

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BRONCHIECTASIS AND ITS SURGICAL CONSIDERATIONS

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THE surgical treatment of bronchiectasis has passed through a number of evolutionary stages up to the present well established and accepted method of treatment, which is partial lung resection. In passing through the various stages and methods of treatment a good many factors have been learned regarding this particular disease, of the use of the various technics[1] of thoracotomy and pulmonary resection, and of pre- and postoperative thoracic physiology. Bronchiectasis is probably the one disease most suitable for and amenable to pulmonary resection. Not very many years ago, however, case fatality rates from resection were quite high, reaching 40 to 50 per cent or more. Recently the rate, as reported by experienced surgeons, has dropped as low as 3 per cent. Indications are that it will be reduced still further. The advent of the sulfonamide drugs and penicillin and their use pre- and postoperatively unquestionably play a very important part in avoiding postoperative pulmonary complications that were so frequent in these cases.

The natural course of bronchiectasis and its interruption by the procedure of lobectomy is still not thoroughly established in the minds of many physicians. At the risk of repeating what is already known some statistics and comparisons of medically and surgically treated cases will be given.[10,13,57,59,66] Perry and King[57] analyzed 400 cases treated at the Massachusetts General Hospital, between 1926 and 1938. Of these, 140 were treated surgically. In this number were included fourteen who had a thoracoplasty or the old exteriorization type of lobectomy. Of the non-surgical group 55 per cent had been traced by January, 1939, and found to be living while 26 per cent were known to be dead. Riggins[59] reviewing 100 cases reports the morbidity as: 25 per cent doing full time work, 40 per cent able to do part time work, and 35 per cent not able to work. Of the surgical cases in which the modern type of pneumonectomy or lobectomy was done, an operative fatality of 3.3 per cent was found. Of the entire group 109 were traced and only two were found to be dead. These figures are not exactly comparable but indicate a definite advantage to the surgical type of treatment. If in addition the complications[25,60,66] of bronchiectasis such as atypical and recurrent pneumonia, lung abscess, cor pulmonale, brain abscess, empyema, emphysema and amyloid disease are considered, together with the fact that patients are chronic invalids and thus subject to other diseases, the advisability of surgical interruption of the natural course of the disease is emphasized.

The above quoted statistics apply to a not so recent series of cases. The medical treatment of the disease of bronchiectasis and its underlying pathology of fibrosis, stenosis, recurrent infection, etc., has changed very little recently. However, the results and methods of surgical care have changed in recent years. With modern methods the previous statistics as to surgical results may be considerably improved.

Etiology. The etiology of bronchiectasis has been studied by a good many men.[3,26,40,46,60,70,71] There are some disease conditions that very definitely cause or lead to bronchiectasis. These are recurrent childhood pneumonias, complicated or severe cases of measles or pertussis, inflammatory strictures of the bronchi, tuberculosis with bronchial stenosis such as foreign bodies, adenomas and cancer. Other

theories as to the cause of bronchiectasis involve the possibility of congenital weakness of the bronchi or bronchial musculature, and chronic allergic bronchitis. The relationship between chronic sinus infection and bronchiectasis has been discussed repeatedly. The actual mechanism involved in the process of development of the bronchial dilatations is not entirely agreed upon. Kline[40] states that it is due to a defect in the muscular and elastic tissue of the wall of the bronchi. Robinson[61] states that it is due to an inflammatory destruction of the bronchial wall with subsequent fibrosis, and he suggests that the infection could be blood borne. Warner[70] says that the enlargement of the bronchi during inspiration is exaggerated in inflammation and leads to permanent changes. Andrus[3] believes that the changes are brought about by atelectasis plus the pull on the bronchi as a result of the changed intrathoracic pressure. McNeil, McGregor and Alexander[46] state that destruction of tissue and not dilation is the cause of the changes in the bronchi.

Incidence. It is difficult to determine the actual incidence of bronchiectasis in general because of the difficulty of an accurate diagnosis and the common disregard of a chronic cough, particularly if the chest *x*-ray is negative. Often these patients are not seen by the physician until some complication develops. The true diagnosis of a case is often made only after repeated complications have occurred and a thorough study is instituted. A good many cases are being seen in various clinics, particularily those for children and young adults.[22,42,46] Bronchiectasis appears to be a not infrequent cause of chest complaints in this and other age groups.[51,44]

In a recent chest survey[29] of 442,252 individuals, 4,982 non-tuberculous lesions were found and of these 252 or 0.057 per cent or 1 in 1800 were diagnosed as bronchiectasis. These figures are, of course, not accurate as a definite diagnosis can be made only by specialized diagnostic procedures using radio-opaque material. However, they are suggestive and may give some indication of the disease incidence.

Pathological Changes. The pathological changes[14,35,61,66,74] that are present when bronchiectasis has advanced to the point where it can be diagnosed clinically and by bronchograms must be considered to be irreversible for the most part. It is true that the removal of a foreign body or other bronchial obstruction may relieve the patient of many of his symptoms,[27] and that an adequate medical regimen may occasionally convert a "wet" to a "dry" bronchiectasis, but the pathological changes of dilatation and fibrosis remain. Whether the changes occur as a result of a pulling force, a dilating force, or a destructive process, the fact remains that there results a dilated, fairly rigidly walled, fibrosed structure which will not return to its original condition. The bronchial dilatations may take several forms, the two main types being the saccular and the cylindrical or tubular forms.

Diagnosis. The diagnosis[2,14,19,24,34,45,52,53,63] of bronchiectasis is so important for the successful treatment of the disease that we wish to mention the method we use. A bronchogram is absolutely necessary for a thorough diagnosis, and any discussion of methods is primarily concerned with technics of bronchial injection. The importance of a thorough study cannot be overemphasized, particularly at present when segmental resections of portions of lobes are being performed.[12] An incomplete injection may fail to reveal an anterior or posterior group of dilatations, involvement of the right middle lobe, or the lingula on the left. We do not believe that bronchoscopic catheterization of the various divisions, or the passage of catheters is necessary for the injection. A much simpler and equally satisfactory procedure is the instillation of warmed opaque media using the usual office syringe with a curved cannula or needle and with the patient leaning to one side, or the insertion of an 18 gauge needle through the cricothyroid

membrane under local anesthesia and the injection of the medium in this manner. It is necessary to inject only a small amount of opaque media, 10 to 12 cc. being used for the injection of the lung on one side, or a total of 20 to 25 cc. for a complete injection of the lung on both sides. Following injection or during injections, if the needle through the cricothyroid membrane is used, various positionings can be employed to outline the several lobes and divisions of the bronchi.[2] These latter procedures cause the patient little or no discomfort.

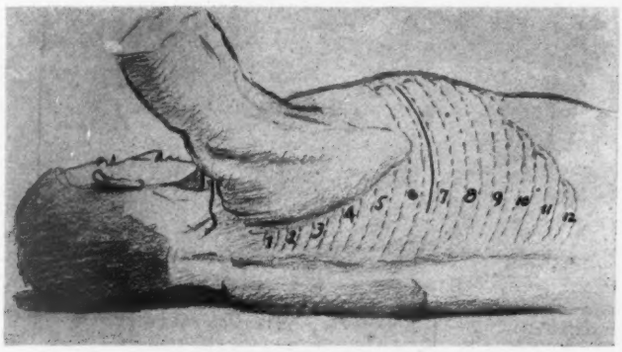

Fig. 1. Posterolateral incision.

A good many cases of bronchiectasis have undoubtedly been overlooked by all of us because of the hesitation in using lipiodol or some similar opaque media in these patients. This is particularly true in children. However, if one keeps in mind some of the clinical features of this condition, many unnecessary injections can be avoided. The history of recurring respiratory infections, the presence of a chronic productive cough, the presence of a fetid sputum increased by dependency and perhaps characteristically layered, hemoptysis and a secondary anemia are certainly suggestive of the condition. A good many other clinical signs may be present at times which will aid the diagnosis of bronchiectasis. For the future welfare of the patient, a diagnosis should not be missed as a result of our hesitation in using lipiodol.

A non-productive or "dry" type of bronchiectasis has been described. This is said to cause fewer symptoms and complications, and may need little or no treatment in some instances. The actual incidence of this type of bronchiectasis is uncertain.

Treatment. As previously mentioned the generally accepted method of treatment that is considered best at the present time is lobectomy.[15,16,18,29,31,39,42,56,57,68] However, this can be carried out with a justifiably low mortality only in cases with unilateral one lobe involvement (or one lobe and the middle lobe on the right, and the lower lobe and lingula on the left). Bradshaw and O'Neil[12] in reporting seventy-six cases stated that in twenty-four cases with one lobe involvement the mortality was 4.2 per cent, in twenty-six cases in which one lobe was removed but others involved the mortality was 15.4 per cent, in seventeen cases in which two lobes were removed the mortality was 18 per cent, and in nine cases in which pneumonectomy was done the mortality was 44 per cent. This, of course, must vary in different clinics. Many cases have been reported in which multi-lobe lobectomies and pneumonectomies for bronchiectasis have been done.[11,30,35,54,55,62]

The usual medical measures[64] can be used in those cases not suitable for surgery and in preparing other patients for surgery. These measures include dependent drainage,[49] bronchoscopic aspiration,[20,33,48,50] bronchial irrigations,[65] iodized oil[4,52,63] and sulfonamide injections[43] and vaccines. Recently penicillin solutions have been used as sprays and inhalations in an attempt to relieve the infection and drainage. We have used penicillin on several occa-

sions, but did not notice much improvement. Bereck, in 1934, first advocated *x*-ray treatment[55] in an attempt to convert a "wet" to a "dry" type of bronchiectasis. It was also suggested that the *x*-ray stimulated antibody formation and tissue resistance. However, the result of treatment by *x*-ray of different series of cases has shown the results are not satisfactory. The elimination of foci of infection in the teeth, tonsils and sinuses[32,72] and the correction of any factors of malnutrition are standard procedures prior to operation. In the presence of any recent flare-up of focal infection a sufficient period should be permitted to elapse prior to operation to insure a thorough recovery of the patient. We are not, however, in sympathy with the idea of a period of three to six months' routine observation before carrying out surgery. In one of our cases the patient, a child twelve years of age, after a period of about three months returned to the hospital with pneumonia from which he subsequently died. Timely surgery might have prevented this.

We have been placing our recent cases on sulfadiazine or penicillin for several days prior to operation and continuing the administration of the drug for four to five days postoperatively. Postural drainage is used the morning before operation.

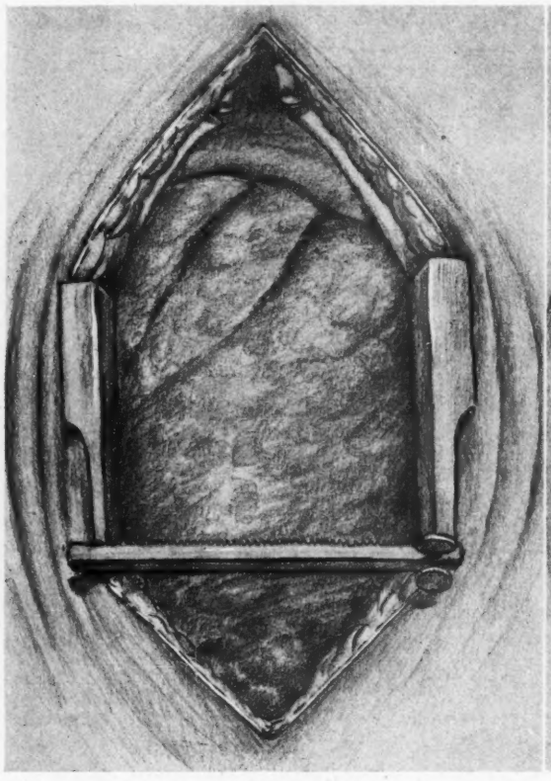

FIG. 2. Exposure of lobes of the lung, on the right.

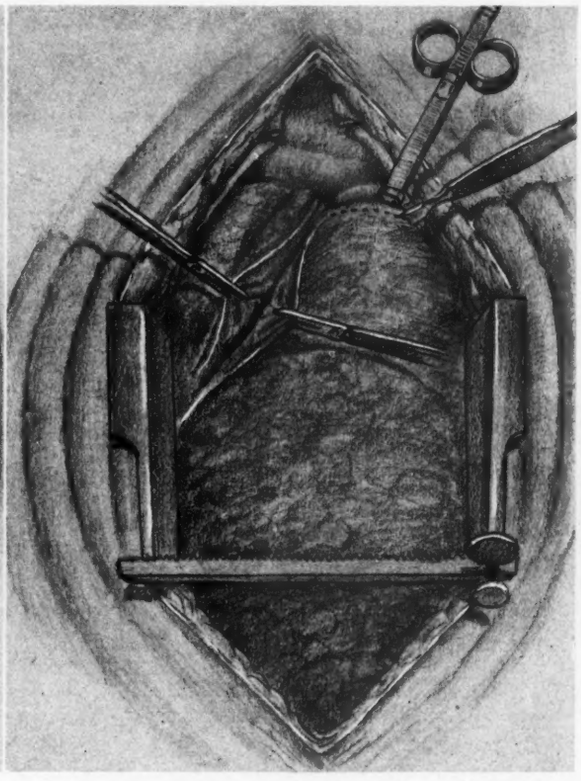

FIG. 3. Removal of lower lobe (tourniquet in place).

Our operative procedure has been carried out under intratracheal anesthesia using a closed method with controlled pressure. Five hundred cc. or more of citrated whole blood is given routinely during the operation. The operative approach to the lung varies according to the preference of the individual surgeon.[1,7,8,9,37,38,67,69,73] The posterolateral incision is the most commonly used; the lateral incision or the anterior incision is also used. Some operators resect a rib, others cut them posteriorly or anteriorly and make the incision in the interspace. We have tried several ways and believe that a lateral incision through the rib interspace with sharp divi-

sion of the costal cartilage anteriorly gives good exposure and less subsequent discomfort to the patient. If the ribs are cut posteriorly, a small section should be removed to avoid postoperative overlapping, friction, and pain. Injection or crushing of the involved intercostal nerve from within the chest upon the completion of operation may give a temporary interruption of the nerves, with relief of the pain. The drawings in Figures 1 to 4, although diagrammatic, indicate our operative method.

Fig. 4. Suture of lower lobe hilar structures.

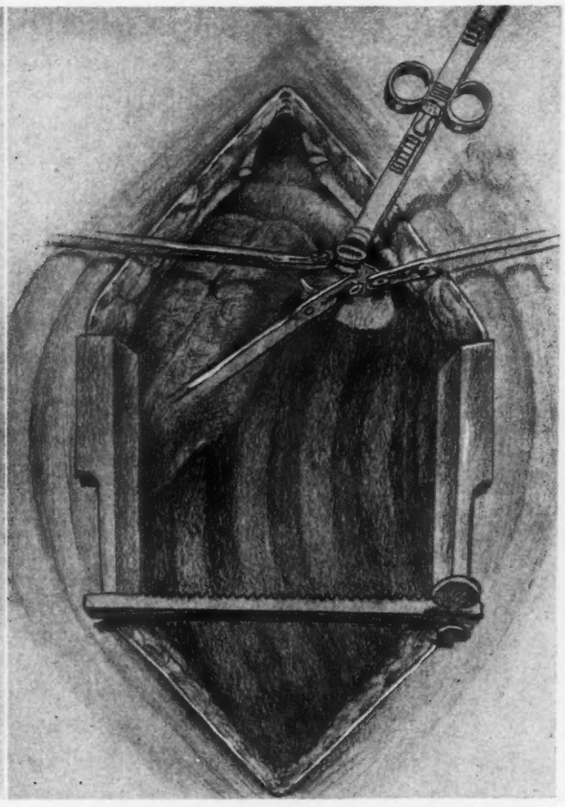

Fig. 5. Dissection and ligature of hilar vessels and suture of bronchus.

As shown in Figures 3 and 4, there are two main ways of treating the hilar structures, the use of a tourniquet or dissection of the hilar structures with individual clamping of the vessels. The latter method is probably more accurate, but there is one thing to be said for the tourniquet method; it is easy to use and the subsequent suturing and closure of the bronchi involve the secondary divisional bronchi. There has been the belief and some recent evidence tends to show that suture of the secondary bronchi is less likely to result in bronchopleural fistula. Used properly the tourniquet will allow an adequate resection. The anatomical dissection of the hilar structures is the more accurate method, however, and with the present knowledge and methods of handling the bronchial stump is considered the best way to handle these structures.[1,15,18,58]

At the close of operation we always insert a catheter into the region of the removed lobe or lobes, place sulfonamide in the chest and gently re-expand the lung just before closure. The catheter is attached to constant Wangensteen suction as soon as the patient is returned to bed and left in place four to five days. We believe that the first twenty-four hours of suction on this tube is of the utmost importance in the postoperative care. This maintains or brings the remaining lung out to the chest wall in full expansion. After twenty-four hours the remaining lung probably becomes adherent to the parietal pleura and will not

become atelectatic. In addition the suction tends to stabilize the mediastinum in the normal position, prevents subcutaneous emphysema, and removes the irritative pleural fluid that results from the operative manipulation and exposure, or the presence of the sulfonamide.

CASE REPORTS

Case I. W. S., a seaman, age fifty-one, had a bronchiectasis of the right lower lobe, cause undetermined. He was operated on December 7, 1942, and recovery was essentially uneventful. The patient had a good result and is working at the present time.

Case II. D. J. G., in the Maritime Service, age twenty-two years, had a bronchiectasis of undetermined cause, of the left lower lobe. He was operated on March 29, 1943. Recovery was essentially uneventful and the patient is now working.

Case III. D. G., a colored male, age forty-five years, a veteran of World War I, had an abscess of the right upper lobe which bronchograms revealed to be on the basis of a bronchiectasis of the right upper lobe bronchi. He was operated on June 17, 1943. This was a somewhat difficult case as the apex of the lung was plastered to the apical pleura by dense, fibrous adhesions, and considerable manipulation of the lung was required to develop the hilar area. The patient developed a severe left lower lobar pneumonia which did not respond to intensive medication including blood transfusions. He died July 13, 1943, with left lower lobar pneumonia.

Case IV. M. W., age thirty-two years, a seaman, was transferred to our hospital for treatment of an abscess of the right lower lobe, which bronchograms revealed to be on the basis of bronchiectasis, and which was confirmed on pathological examination. A right lower lobectomy was done January 25, 1943 and recovery was uneventful. He was seen and examined nine months later and was working and in good condition. *X*-ray revealed some elevation of the diaphragm, but the chest was otherwise normal.

Case V. W. R. E., in the Maritime Service, age thirty-six, entered the hospital with an abscess of the lower lobe of the left lung. Bronchograms revealed bronchiectasis of the lower left lobe. On June 6, 1943, a lobectomy of the left lower lobe was done. The patient's recovery was uneventful. On October 3, 1943, the patient was working and had no complaints. On February 12, 1944, a letter from the patient stated that he had an abscess of the upper lobe of the left lung and that he had been discharged from the Maritime Service. The patient again wrote that the abscess had cleared up rapidly and that he was back at his old work.

Case VI. J. C. B., was a Coast Guardsman, age twenty-four. Bronchograms revealed that the patient had a bronchiectasis of the left lower lobe due to unknown cause. He was operated on July 9, 1943, and left lower lobectomy was done. The patient made an uneventful recovery. Six months later the patient stated that his weight was back to normal and that he was back on duty.

Case VII. W. E. P., a Coast Guardsman, age thirty-six, had a history of recurring bronchitis and sinus trouble. Bronchograms revealed a bronchiectasis of the right lower lobe due to infection. The man was operated on June 8, 1943, and made an uneventful recovery. In January, 1944, the patient was still in the Coast Guard and working. He had no complaints.

Case VIII. F. E. A., a seaman, age twenty-one years, was examined and revealed a bronchiectasis of the right lower lobe. The patient was operated on June 6, 1943, and made an uneventful recovery. One year later the patient reported that he was working daily and his weight was back to normal with no complaints.

Eight cases of bronchiectasis are reported in which lobectomy was done. In this series there was one death. This patient had bronchiectasis of the right upper lobe and death was due to lobar pneumonia in the left lower lobe. The ages of these patients varied from twenty-one to fifty-one years. All were back at their usual work. One patient stated that he had been discharged from the Maritime Service because of a left upper lobe "abscess." He had been working since operation until this developed. He had had a left lower lobe lobectomy. Recently he reports that his left lung had cleared up and that he has returned to work. Several patients were in the Coast Guard at the time of operation and it is interesting to note that they

were afterward retained in the Coast Guard and at present are carrying out their usual duties. There were four right lower lobe lobectomies, three left lower lobe lobectomies, and one right upper lobe lobectomy. There were no empyemas, bronchopleural fistulas or other complications.

SUMMARY

1. A moderate review of the literature has been made and the importance of bronchographic diagnosis and surgical treatment has been emphasized.

2. The irreversible pathological changes that are a part of the picture of bronchiectasis are outlined, and the high incidence and types of complications are discussed.

3. The experience of various workers is discussed and figures cited relative to medical versus surgical management of the disease. These factors together with the present low fatality rate in the operative procedure appear to support our belief that lobectomy is the treatment of choice in bronchiectasis.

4. Eight cases of bronchiectasis in which lobectomy was done are reported and the technic which was used is outlined.

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EVALUATION OF THE TREATMENT OF CANCER OF THE BREAST*

WITH A SUGGESTION FOR ITS MODIFICATION

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SO much has been written of cancer of the breast, that interest in the subject would cease to exist were it not for the fact that first, it represents 10 to 12 per cent of all cancers treated, and second, we are confronted with the statement that the medical profession has not increased its percentage of cures in the past twenty-five years, except through early diagnosis. Technically, the operation has shown only minor advances. It is a matter of common knowledge, common to the profession at least, that cancer in general, including the breast, is increasing and has not deviated from the original pattern in the main, although some refinements in the pathological diagnosis have been attained. The cancer of our grandmother is our cancer today. It is no cause for alarm or apprehension to note this increase in the frequency of malignancy.

Preventive medicine has eliminated so many diseases of childhood and adolescence that the average duration of life has been projected into the zones where malignant disease is the captain of the men of death, and takes its toll. As life is extended through prophylaxis and therapeutic discoveries, many diseases which are common now will cease to exist; and unless we discover the cause of cancer, or have means of eradicating it, the incidence of cancer will continue to spiral upward. This should not give us so much concern as the challenge that we have no better results in cancer of the breast today than we had three decades ago. It is difficult, maybe impossible, to refute such a statement. I doubt very much if the radical mastectomy is done any better now than it was done by Halstead.

Probably the only notable advance in the treatment of cancer of the breast is early and positive diagnosis and by irradiation, either by *x*-ray, radium element or emanations. Outside of these measures, what advance has been made in the treatment? Scarcely any. And what has irradiation added? That is an involved question and the subject that deserves consideration not alone by the roentgenologist, but by the surgeon as well.

Warfare upon disease is in some respects like military warfare. It has been only too apparent that the various branches of our armed forces have met with their greatest successes by intelligent collaboration. If we can appropriate a lesson from that experience, it should be plain that all branches of our profession interested in the cure of cancer should unify their efforts in this direction and not be content to work alone in a restricted field. The surgeon, the roentgenologist, the pathologist and the internist should pool their knowledge and apply it to the problem.

The publicity given cancer has doubtless succeeded in driving into doctors' offices many cases of cancer early enough to be cured. It seems to be universally accepted that a radical excision of the breast for cancer before metastasis to the axilla or elsewhere, is followed by a five-year cure in 70 to 75 per cent of the cases. The profession seems more alert to the necessity of early treatment; the frozen section has

* Read before the Staff of the Gallinger Municipal Hospital, October 23, 1945.

become almost routine in making possible a very early and accurate diagnosis, with its corresponding good prognosis.

I hope the day has long since passed when palpable axillary glands serve as a confirmatory diagnosis of carcinoma of the breast. It is almost safe to make the statement that when the original growth is fixed either to the muscle or skin, it has already metastasized, at least microscopically; no one can believe that carcinoma of the breast spreads by lymphatics alone, because it cannot explain early extension to the brain, lungs, or skeleton.

Many more cases of carcinoma are seen earlier than they were thirty years ago, and the number of patients rescued from a lingering illness has certainly increased; this can be credited to the better informed general practitioner and a public that is cancer conscious.

In those cases in which metastasis exists in the axillary glands or elsewhere at the time treatment is undertaken, the figures are reversed; we have 25 per cent cured and 75 per cent live less than five years, although many clinics present better figures, but for the country at large, the figures stand. It is evident that if we expect any satisfactory improvement in the present status of cures, we must be able to operate on more patients while the disease is confined to the breast or else find a means of overtaking metastatic invasion. This is the crux of the cure of cancer today, and it matters little if it can be done by surgery alone, irradiation alone or a combination of the two.

We should proceed to analyze the situation by breaking down the problem into its elementary factors: (1) The diagnosis of carcinoma of the breast must be by pathological examination only, for no series of cases with a clinical diagnosis only can be acceptable as a basis for comparative study. Even the punch biopsy is open to serious objections; any pathologist will verify the statement that only an exhaustive examination of sections will give a correct diagnosis in many breast tumors, and a punch biopsy is of value only if malignant cells are seen. Therefore, reports of cures by irradiation or by surgery without pathological examination should be discounted. (2) Carcinoma of the breast with metastasis yields only 25 per cent five-year cures. Who is to say when metastasis is present? Is it the surgeon or the pathologist? Certainly it is not one who examines the patient prior to operation, when attempts to palpate glands in the axilla are usually futile. Deep metastatic extensions often cannot be palpated, and glands that are palpable in the axilla in a patient with carcinoma of the breast, are not necessarily malignant. Palpation will not differentiate the malignant and inflamed gland. The operating surgeon is better qualified, by mere proximity, to palpate glands, but here, too, the differentiation cannot be made by the fingers, although he can be reasonably certain of the diagnosis. Only the pathologist is qualified to pass judgment, and then only after a meticulous search through the axillary fat, backed up by an equally painstaking inspection of the slides. The percentage of error by microscopical diagnosis is small but not negligible. The borderline case, and certain types of mastitis, have been the source of error only too frequently; however, as long as the human element is involved, namely, the interpretation of a picture, errors will creep in. It is on the pathologist's statement that the prognosis is based. It may be modified by the grade of malignancy (Broder's classification) but in a large number of cases reported by many observers it can be stated as essentially true that only 25 per cent of cases with axillary metastasis remain alive after five years. This does not imply that 25 per cent are cured; if we took a ten-year period as a yard stick of cure, 5 per cent, possibly more, could be deducted from the 25 per cent as cured, omitting those who died of disease not associated with cancer of the breast. Twenty-five years ago, we were satisfied with a three-year cure; now we measure with a five-year period; is it fair

to ask what shall be the minimum period in 1965?

X-ray and radium were hailed as almost a panacea for cancer of the breast; for some years considerable faith was placed in this treatment. Outstanding roentgenologists apparently proved to the satisfaction of themselves and to some surgeons that there was a considerable extension of life after irradiation. This view has not been fully sustained by reports of Crile, Adair, the Mayo Clinic, and others. If longer life has been granted these individuals, it has been but an average of only a few months. It has not been shown that the age of the patient or the grade of carcinoma can be taken into consideration in the use of irradiation, from a prognostic standpoint. The type of carcinoma may offer a clue as to whether the extension of life will approach the five-year mark or the one-year mark, but these cases do not lend themselves to spectacular results with *x*-ray or radium. We talk glibly of irradiation sensitivity but this must not be confused with curability. The two may be related but are not synonymous.

It must be accepted at the present time that radical operation, plus irradiation, is all that we have to offer in cancer of the breast with metastasis, and be content with a mortality of 75 per cent in the next five years. The prognosis may be modified by the type and grade of tumor; from a recent report, age is not a factor, although it is contrary to my personal experience.

In the records of any surgeon, case after case can be found in which carcinoma of the breast with axillary metastasis was treated by a radical mastectomy followed by irradiation in a series of treatments, concentrating on the paths of extension. All goes well for two or three years, then swelling of the arm becomes annoying, a non-productive cough may be a persistent symptom, or vague pains in the back or pelvis send the patient to his doctor; the answer is only too evident—metastasis beyond the hope of cure by any known means.

We believe that irradiation does retard or partially arrest malignant growth, particularly those malignancies that are sensitive to the rays. The changes which occur in malignant tissue as the result of *x*-ray treatment bear this out. It would appear that malignant cells, less viable than normal cells, are destroyed or immobilized by irradiation, but some become activated after a long dormant period.

McCarthy and Leddy, of the Mayo Clinic, have recently reported some interesting observations on the roentgen treatment of inoperable carcinoma of the breast. It covers a series of ninety-eight patients between 1925 and 1940, in which the multiple converging beam technic was employed in a series of treatments lasting from a few months to four years.

To quote, "Those patients who received three or more courses of multiple converging beam therapy lived slightly more than a year and a half after treatment had been started. We believe that only the patients who were treated three times received adequate roentgen therapy."

Two patients each sixty-five years of age had lumps in their breasts, ulceration, fixation, and lymph nodes. Each received eight and nine courses of treatment for a period of four years.

"Re-examination at the clinic just prior to the cardiac exitus in each case failed to reveal any clinical evidence of a malignant process. We mention these two patients merely to illustrate what can be accomplished."

It appears to us that we have neglected a very valuable agent, or have failed to use it in an intelligent manner. Irradiation prior to operation has probably not been used to its best advantage. There is probably a field for this type of therapy and it should consist of concentrated radiation for two or three days followed by operation in four or five days. Inhibition of cell activity to a variable degree and period of time may be expected, but sclerosing changes develop in a slower fashion, consequently the fusing of soft tissues is not encountered in an early operation.

If it is possible to arrest malignancy for two years by irradiation, would it not seem most rational to repeat the treatment in two years, and again in two years, to attenuate and eventually destroy the malignant cell? So far as we know, no systematic plan has been followed to treat carcinoma of the breast by irradiation at stated periods after the original treatment. It is not believed, of course, that immunity to cancer can be established by any form of treatment. Fractional or periodic irradiation spaced two or three years apart may arrest or destroy feeble cancer cells which have become activated after a single series of treatments. Whether the death of the cancer cell is due to incarceration in a fibrous ring, or to direct action of the ray is immaterial; if they can be held in a state of inactivity in excess of the five years, we can probably increase the number of cures as well as the period in which the patient remains well.

I am convinced that periodic irradiations spaced two or three years apart has nothing to lose, but perhaps much to gain. I am instituting this type of treatment in patients who apparently are cured; at least they present no clinical evidence of recurrence. It will be difficult to get all patients to cooperate but this in itself will be no cause for regret, as the two groups, those who have periodic *x*-ray and those who do not; form a control group and a treated group, but it will take some years to arrive at any conclusion that will be acceptable. In five years there will be enough data to encourage further studies or to abandon the principle of surgery plus periodic irradiation.

SUMMARY

In the treatment of cancer of the breast, we have reached a place where the prospects of reducing the early mortality or extending the span of life seems to have reached an impasse, unless we can better apply the tools at our disposal.

Much has been accomplished by publicizing the prevalence and curability of cancer in its early stages, and while these efforts should be continued, no great impression will be made in the vital statistics by this alone.

No longer should carcinoma of the breast be so designated without miscroscopical examination of the tissue, and compilation of cases treated without such verification should not be given printer's space. The punch biopsy only in its positive reports of carcinoma is entitled to any consideration from a diagnostic standpoint, and it would be far better if the method were abandoned altogether. Brodus has definitely established the value of grading cancer, and every effort should be made to get in line with his observations.

We have two methods of attacking cancer of the breast, irradiation and surgery, and it is very questionable if we have exhausted the possibilities of the two, particularly as a dual method of attack. There has been too much half-hearted cooperation between the surgeon and roentgenologist. Irradiation alone has not lived up to the expectations; or possibly too much was anticipated, no doubt predicated upon a limited experience or a few outstanding cases. If the methods of treatment by irradiation now in vogue have failed materially to increase the number of cures or prolong life, possibly the utilization of this potent therapeutic measure can be better adapted and coordinated with surgery.

It is conceded that irradiation inhibits many malignant growths, and any treatment that can arrest the propagation of cancer cells has a place in the treatment of cancer. Combined with surgery, irradiation can play an important part in the treatment of cancer of the breast.

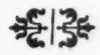
Preoperatively, a short period of intensive treatment by *x*-ray or radium, should be followed immediately by radical surgery. Irradiation alone, or delayed surgery after irradiation has not been justified by the end results. Postoperative irradiation has been rather "hit or miss" in its application, no effort apparently having been made to standardize the treatment in dos-

age, periodicity in relation to the operation or careful tabulation in regard to the extent, type or grade of cancer, except in few of the centers in which this problem is a matter of major importance. Unfortunately perhaps, most of the cases are not treated in the best organized clinics.

The postoperative treatment of cancer of the breast, we believe, needs coordinating. Irradiation should be carried out early in the convalescence of the patient and repeated at two-year intervals regardless of recurrence or in the absence of recurrence, over a period of four to six years, assuming the patient survives.

Notations as to the type and grade of cancer, metastasis, local recurrences are essential to supply data that can be applied to formulate future treatment of carcinoma of the breast.

Until we utilize irradiation in an intelligent manner in combination with surgery, we shall just muddle along in a therapeutic rut. It is incumbent upon us to apply, with a sense of responsibility, all those measures that we have in our hands and not casually wait for some genius to throw in our laps a specific "carcinomastat." This program will require years to consummate, but it will be worth the labor.



From pelvic organs, metastases are found in the iliac nodes first, next the inguinal nodes, then to the skin through the vasa lymphatica abdominis.

From "Metastases Medical and Surgical" by Malford W. Thewlis (Charlotte Medical Press).

BENIGN TUMORS OF THE VULVA

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BENIGN tumors of the vulva are rather uncommon. Their appearance should be recognized early if we are to practice preventive gynecology and thus control vulvar cancer. Less than 200 cases have been reported in the literature which contains many excellent reviews and treatises on experiences with vulvar tumors. In this paper we are concerned with benign tumors of the vulva accompanied by a classical case.

ANATOMY

The vulva includes the labia majora, labia minora, mons pubis, clitoris, and those structures contained in the labia, including the glands of Bartholin. The meatus urinarius and hymen, although not entirely vulvar in origin, are often considered as a part of the vulva because of their close relation to other vulvar structures. The skin and accessory cutaneous structures of the vulva occupy an important relationship to the vulval integument of the human female. The generally benign character of simple tumors developing in these structures has created little respect for their occasional malignant propensities. Benign tumors of the vulva are an interesting group, because of the above variety of tissues in this area of the human body.

GENERAL CONSIDERATIONS

Incidence. Fibromas and fibromyomas arising from the external genitalia in women are comparatively rare. The exact incidence is unknown. Burr, in 1905, at the University of Michigan Hospital, did not find a single case of vulvar fibroma in 5,000 cases tabulated on the gynecologic service. Leonard, in 1917, at the gynecological clinic of Johns Hopkins Hospital found only six fibromas of the vulva among the 23,000 patients admitted to the hospital. In 1929, Brady stated that less than 175 fibromas of the vulva have been reported in all medical literature. A further search through the literature has not revealed many more case reports on the subject, but many authors have placed greater emphasis on vulvar tumors with special reference to both their benign and malignant characteristics. Undoubtedly many more cases of benign tumors of the vulva have been seen, recognized and treated. Fibromas of the vulva are of sufficiently rare occurrence to make the report of a case worth while.

Heredity. At present there is no accurate information concerning the relationship of fibromas of the vulva to heredity.

Age. Vulvar fibroma rarely manifests itself in infancy or adolescence. Cases on record demonstrate the initiation of symptoms at the age of sixteen (youngest) and sixty-nine (oldest), although the majority in a series of thirty-four cases were of childbearing age, ten were more than fifty years of age. Aichel, in 1912, reported a case of a fibrous tumor appearing at the vulva of an infant. The vascular changes accompanying menstruation and pregnancy are shared by these tumors. This is clearly demonstrated by the swelling and sensitiveness experienced by patients during those periods. Herein lies the explanation of the theory that, generally, vulvar fibromas occur in the childbearing period.

PATHOLOGY

The majority of benign neoplasms of the vulva are of connective tissue origin: fibromas, leiomyofibromas, lipomas, hemangiomas, neuromas, leiomyomas, ganglioneuromas, lymphangiomas and enchondromas. Of this group, fibroid tumors

are by far the most frequent of the benign solid neoplasms found in this region.

Benign tumors of the vulva of epithelial origin include true papillomas, condylomas, endometriosis, accessory breast tissue, epidermoid cysts, hidradenomas or sweat gland adenomas of the vulva and moles.

A large group of the vulvar neoplasms of connective tissue origin originate in the extraperitoneal portion of the round ligament. Commencing on either side at the lateral angle of the uterus, this ligament is directed forward, upward and lateralward over the external iliac vessels. It then passes through the abdominal inguinal ring and along the inguinal canal to the labium majus, in which it becomes lost. According to Leonard, as many as 33 per cent of these tumors arise in this manner.

Nearly all fibromas show degenerative changes if allowed to develop for too long a time. Neoplastic fibroid tumors of the vulva are more prone to degenerative processes than similar tumors in any other part of the body. Due to the fact that these tumors are subjected to marked variations in their blood supply during menstruation and pregnancy, which causes rapid growth, and by growing rapidly the majority soon become pedunculated, they develop ideal mechanical conditions for degenerative processes. Lovelady in discussing the pathology of sixteen fibromas, found that the majority were made up of fairly adult fibroblasts, which formed spindle cells, and varied in diameter from 6 mm. to 8 mm. Mitotic figures were not demonstrated. Myxomatous degeneration was a common finding. Although several of the fibromas were cellular none were considered sarcomatous. Hellman in a series of sixty-four cases found malignant changes in fourteen cases or 22 per cent. Leonard showed that nearly one-fifth of these tumors (nineteen of 103 cases) became sarcomatous. Folsome at the University of Michigan Hospital found sarcomatous changes in one of nine cases, an incidence of 11 per cent. Other pathological changes which have been described in the literature relative to degenerative processes in benign vulvar tumors are edema, lymphangiectasis, hyaline and cystic degeneration, calcification, ulceration, infection and gangrene.

CLINICAL MANIFESTATIONS AND COURSE

The lack of clinical symptoms in cases of benign tumors of the vulva is an outstanding feature. The tumor when first seen usually appears as a small, firm, smooth, painless round or oval nodule immediately under the skin of the labia majora. The tumor may be discovered by the surgeon during a routine pelvic examination but usually it is the tumor's rapid growth which brings the patient to him for consultation.

The tumor usually becomes pedunculated and with continued growth produces symptoms due chiefly to the weight and location of the mass. Actual interference with locomotion or mild urethral irritation, if the tumor mass involves or pulls the urethra, may be the first inconvenience experienced by the patient. Likewise the weight may cause mechanical difficulties by interfering with the urinary sphincter mechanism causing frequency or urinary incontinence. Occasionally, pain with ulceration of the epithelium over the neoplasm causes the patient marked mental distress concerning the possibility of malignant change in the tumor. Large tumors may prevent coitus or become an obstacle at labor.

These tumors when first seen have in most cases, a definite well marked pedicle, which hanging between the thighs bears a remarkable resemblance to a male scrotum thus presenting a clinical entity and illustration, which cannot be forgotten easily. The tumor is generally covered with hair. The skin is thick and reveals numerous wrinkles and shallow folds, especially between menstrual periods. The literature comments frequently on the remarkable resemblance of some of these tumors to the scrotum and in one case, a diagnosis of hermaphroditism was made, the firm, rounded elastic tumor being mistaken for

a testicle. The skin is freely movable over the tumor, and its surface is generally quite unbroken, although there may be several small areas of epidermis presenting a glistening appearance which is usually due to friction.

On palpation, the tumors seem to consist of rather firm, smooth or slightly lobulated tissue of the same consistency as fibromas elsewhere in the body. Moderate pressure does not produce pain. One or more pulsating vessels may be felt in the pedicle. If the circulation becomes impaired the tumors may become semifluctuant or edematous. Sometimes by pulling the tumor thereby making tension on the pedicle, a tough fibrous cord may be made out transversing the pedicle and entering the inguinal canal, indicating that the tumor is of connective tissue origin and arises from the round ligaments.

These tumors vary greatly in size, some of them remaining as small non-symptomatic nodules while others grow to enormous size, thus interfering with locomotion, childbirth, intercourse, and are equally disturbing from a psychological standpoint. Buckner, in 1851, reported a very large growth, said to have weighed 121.5 kg. (268 pounds) which arose in the subperitoneal connective tissue and appeared at the vulva.

DIAGNOSIS

The diagnosis of fibromas of the vulva is in most cases relatively easy when based on a detailed medical history and a complete physical examination. Biopsies from various portions of the tumor are necessary to rule out malignant changes and confirm the diagnosis.

DIFFERENTIAL CHANGES

The differential diagnosis of benign vulvar tumors can be based on either their connective or epithelial tissue origin. If they arise from connective tissue, they are either fibromas, leiomyofibromas, leiomyomas or lipomas. In rarer instances they may be hemangiomas, lymphangiomas, neuromas or enchondromas. Those arising from epithelial origin may be papillomas, condylomas, hidradenomas or sweat gland adenoma of the vulva, supernumerary vulvar breast tissue, endometriosis, or cystic tumors of the vulva.

The clinical and pathological descriptions of the above mentioned disease entities are well covered in the literature and in textbooks of surgery, pathology and diagnosis. No attempt will be made here to go into any great detail in giving the clinical differentiation of the above benign vulvar tumors. Some illustrative cases have been selected from the literature, however, to emphasize the importance of making an accurate differential diagnosis.

Occasionally benign fibromas of the vulva are confused with lipomas. Vulvar lipomas are prone to become pedunculated because of their location and the tissues to which they are attached being stretched out to form a broad thin base. Lipomas usually grow very slowly, and, as they are quite painless very seldom cause inconvenience. It is for this reason that not a large number of these cases have been brought to the attention of gynecologists. Kelly, in 1893, pointed out that lipomas of the vulva, in turn, were likely to simulate inguinal hernia. In such cases further differentiation must be made because tumors originating in the extraperitoneal portion of the round ligament can be mistaken for a hernia.

Endometriomas of the labia majora, as reported by Jeffcoate in 1937, have also been found in close connection with the round ligament. Henry reported a case of an endometrial growth on the right labium majus, which he believed was due to transplantation of endometrial cells into the tissues of the labium majus as a result of injuries during childbirth or their lymphatic or venous dissemination, more probably to the latter.

Several investigators have reported accessory breast tissue in the vulva, and Folsome, in 1929, removed a small endometrioma from the mons pubis of a young

woman. Adenomyomas should not be confused with lipomas. Adenomyomas cause severe pain each time menstruation occurs because of swelling and hemorrhage in an adenomyoma at the menstrual periods.

Sometimes the gross and microscopic study of a tumor justify a diagnosis of fibroma of the vulva, because of the preponderance of fibrous tissue; but if there is also an abundance of inflammatory cells and granulomatous tissue, lymphopathis venereum or a syphilitic infection must be considered. A definite choice between these two diagnoses, however, is impossible, as the history and laboratory could support either thesis. In such cases the passage of time and further observation are indispensable.

Cystic tumors of the vulva have been reported by Brady who described a fibroma of the vulva which contained an epithelial inclusion cyst, a tube lined with several layers of squamous cell epithelium and Schauffer and Lunsford described a lymphatic cyst. Elephantiasis of the vulva, sweat gland tumors or hidradenoma and retention cysts of Bartholin's gland and sebaceous cysts have also been reported.

TREATMENT

The treatment is surgical excision. The specimen or tissue removed should always be examined by a competent pathologist. The surgical technic is very simple, and entails usually an elliptical incision about the base of the pedicle, ligation of vessels, and closure of the wound with or without drainage.

CASE REPORT

The case I wish to report is of interest because of the relatively rare occurrence of fibroma of the vulva and because early recognition and treatment of vulvar lesions and tumors will lower the incidence of sarcoma of the vulva.

The patient, a colored obese female, aged twenty-six, was admitted to the Station Hospital, March 27, 1943. She was married and had one child. The family history was unimportant. Personal history revealed that the patient married at the age of fourteen, and

Fig. 1. Photograph taken March 29, 1943, showing the position of the benign fibroma when the patient stands in an upright position. It dangles freely between the thighs, and in this position interferes with locomotion and coitus. Note the striking resemblance to a male scrotum.

delivered a normal, viable male child, one year later. She divorced her husband when she was eighteen and remarried at the age of twenty-five. Menstruation began at the age of thirteen and continued normally. She had had no further pregnancies or abortions, but had been treated for the past nine years for leucorrhea. Other than the local trouble the past history was non-contributory and of no consequence.

About five years before admission the patient noticed a very small firm, itching nodule just to the left of the vaginal orifice. It was not sensitive, and at its onset it looked like a "mole." For the past four years it grew very slowly but quite steadily. During the one and one-half years before admission the tumor rapidly increased in size.

For the past two years, during the menstrual periods, the tumor had usually become swollen and slightly sensitive. At the end of four or five days the swelling and sensitiveness would subside, only to recur with each menstrual cycle. The only discomfort was caused by its size and weight, and its interference with coitus and locomotion. She learned to accommodate herself to the presence of the vulvar tumor by strapping it to her abdomen.

On several occasions the apex of the tumor became quite painful and ulcerated, the last episode occuring six months before admission. She saw four colored physicians over a period

of five years, all of whom recommended surgery, but the patient refused such treatment.

Examination (Figs. 1 and 2) revealed a pedunculated tumor covered with thick elastic wrinkled skin hanging from the left labium majus. In appearance the resemblance of the tumor to a male scrotum was striking. There were no ulcerated areas. The pedicle and mass were not covered with hair, and the apex of the tumor (Fig. 3) had a scarred, indurated, granular central infolding and dimpling appearance. From the base of the pedicle the tumor measured 15 cm. The pedicle was 1.5 cm. in diameter and the tumor mass 6 cm. in its greatest diameter. There was no impulse over the left femoral or the left inguinal rings. The vaginal examination revealed a large fibrotic uterus, freely movable and non-tender. Due to the patient's weight (215 pounds) the adnexal regions were difficult to palpate, and the examination of the tubes and ovaries was not especially satisfactory. It was believed, however, that there was no adnexal disease. The fibroma, because of its location and attachment to the left labium majus, apparently had originated from the terminal fibers of the round ligament.

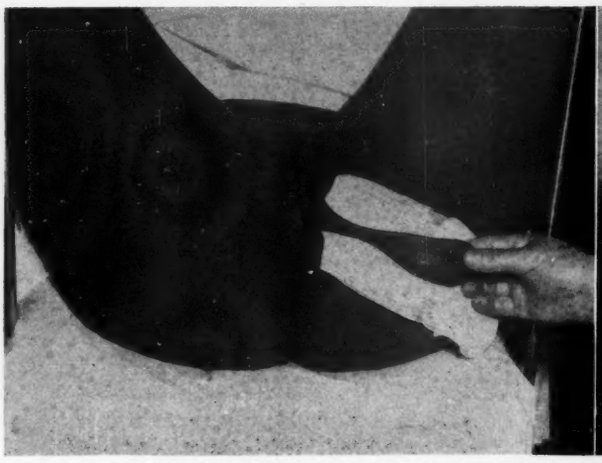

FIG. 2. Showing the attachment of the tumor to the left labium majus.

FIG. 3. The apex of the tumor has a scarred indurated, granular appearance, with central infolding and dimpling.

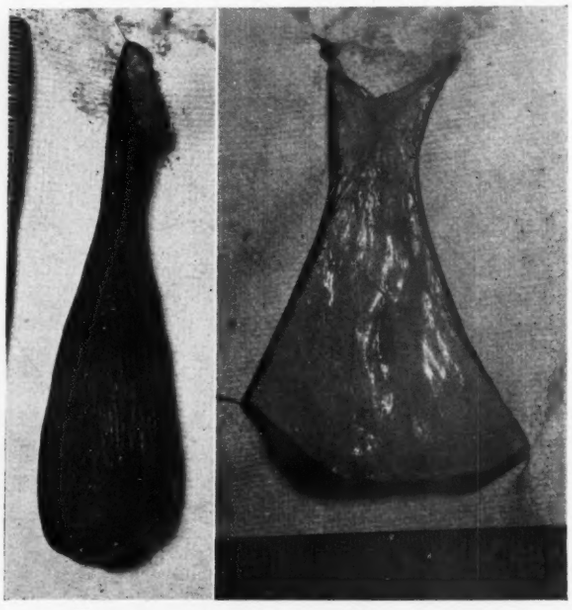

FIG. 4. FIG. 5.

FIG. 4. The tumor following surgical excision. It consists of a polypoid mass about 6 cm. in diameter with a pedicle 1.5 cm. in diameter. It is covered with hairless, wrinkled, pigmented epithelium.

FIG. 5. The tumor split open. It is composed of fibroblasts having spindle-shaped nuclei. They are supported by a very abundant mass of collagen. The tumor is not very cellular. There is considerable interstitial edema. There is no evidence of malignancy.

On March 29, 1943, under local infiltration anesthesia with 1 per cent novocaine, an elliptical incision was made around its base and the tumor removed. (Fig. 4.) A few small bleeding points were ligated with No. 000 plain catgut. The subcutaneous tissues were approximated with three No. 000 plain catgut simple interrupted sutures. The edges of the incision were approximated with a continuous No. 1 black silk mattress suture, restoring the left labium majus to its normal size and shape. No drains were used due to the absence of infection or degeneration. The convalescence was uneventful and healing per primum followed.

The patient was discharged as cured April 4, 1943. She was seen again on April 15, 1944.

There was no evidence of recurrence of the tumor mass, and the patient was asymptomatic and in excellent health.

Pathologically the specimen (Figs. 4 and 5) consisted of a polypoid mass about 6 cm. in diameter with a pedicle 1½ cm. in diameter. It was covered with wrinkled, pigmented epithelium and was composed of edematous fibrous tissue.

Microscopically, the tumor was composed of fibroblasts having spindle-shaped nuclei. They were supported by a very abundant mass of collagen. The tumor was not very cellular. There was considerable interstitial edema. There was no evidence of malignancy and we consider the tumor to be a true fibroma.

SUMMARY

The varied manifestations of benign vulvar tumors are reviewed to re-acquaint physicians with the disease, since less than 200 cases have been reported in the literature. A classical case is presented in detail, clinically and pictorially.

Sarcoma of the vulva may be prevented if benign vulvar simple lesions and tumors are recognized and treated early.

If this treatise serves its purpose, there should be more correct diagnoses, and fewer benign lesions allowed to proceed to a stage of malignant degeneration.

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TREATMENT OF COMPRESSION FRACTURE OF THE SPINE*

WITH A REPORT OF 160 CASES AT FORDHAM HOSPITAL

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THIS paper is not intended to be a detailed article covering the entire field of compression or crush fracture of the spine, as contributions to the literature on this subject have been extensive, many of them excellent. Although some of the suggested treatments have differed in detail, the general plan is the same. This article is rather a sequel to a report of forty-nine cases of this nature which I had encountered at Fordham Hospital from 1916 to 1929.[1] With fractures in general on the increase, the occurrence of compression fractures is of course more frequent. We had from 1916 to 1943 inclusive, a total of 339 cases of spinal fracture. A complete study of these cases may be of some value now with the emphasis in the literature and in the military hospitals on every type of severe injury.

Frequency of Occurrence. Table I shows the spread of these cases through the years from 1916 to 1943. The total is 339 of which 160 (or 47.3 per cent) were compression fracture, clearly indicative of the frequency of this type of fracture.

Types. Two types of fracture of the spine are most frequently encountered: (1) *Compression fracture* of the body of the vertebrae, sometimes called crush fracture, 47.3 per cent in the series here reported. The vertebrae of the dorsolumbar junction, i.e., lower two dorsal and upper two lumbar are the ones most frequently involved. Table III gives the exact location according to the *x*-ray findings; (2) *fracture dislocation,* besides the fracture of the body, the upper adjacent vertebral body is dislocated, usually anteriorly, sometimes laterally.

Pathology of Compression Fractures. In general the ends of the vertebrae are forced together, thus causing crushing or compression of the vertebrae. We have three degrees of compression fractures: (1) Mild compression: Slight wedge-shaped deformity, little or no apparent damage of articular end plates of the centrum, little or no change in the width of the intervertebral space. (2) Severe compression: Marked wedged-shaped deformity, fragmentation of articular end plates, and extensive disorganization of the intervertebral disc showing narrowing or obliteration of the intervertebral space.

TABLE I
NUMBER OF CASES ADMITTED

Year	Total No.	No. of Compression Fractures	Year	Total No.	No. of Compression Fractures
1916	4	2	1930	18	5
1917	9	4	1931	15	7
1918	1	1	1932	16	9
1919	4	3	1933	10	4
1920	4	2	1934	12	6
1921	5	4	1935	24	12
1922	11	5	1936	26	11
1923	7	1	1937	17	9
1924	7	2	1938	27	12
1925	9	5	1939	21	10
1926	14	4	1940	17	11
1927	19	8	1941	15	11
1928	6	4	1942	10	2
1929	8	4	1943	3	2
Total.	108	49	Total.	339	160

Percentage of compression fracture to the total number is 47.3%.

* Read before the Ivrith Medical Society, April 19, 1945.

(3) Central compression: No wedge-shaped deformity. Instead the central portion of the articular surface of the body collapses while the peripheral elements remain relatively intact thus imparting a crater shape or concavity to the compressed portion. Extensive disruption of the intervertebral disc is present, shown by the loss of the intervertebral space.

Table II
SEX

	Total No.	Compression Fracture	Percentage
Men	160	116	72.
Women	173	44	27.

Pathology of Fracture Dislocation. If some portion of the vertebral arch is also involved, a dislocation occurs and the upper adjacent vertebra is dislocated anteriorly or laterally.

Table III
REGIONS INVOLVED ACCORDING TO *X*-RAY FINDINGS

			Per Cent
1. Cervical	1– 4	12	7.5
	4– 7	26	16.2
2. Dorsal	1–10	12	7.5
	10–12	26	16.2
3. Lumbar		84	52

Note: For double cases, counted in the region before:

Two bodies	
Cervical and dorsal	3
Dorsal and lumbar	3
Lumbar	18
Three bodies	
Dorsal	2
Lumbar	3

Pathology of Intervertebral Disc. In spinal injuries the amount of damage to the intervertebral discs varies considerably. In the cases of severe compression the disc is disorganized and nuclear material forces its way through rents in the annulus fibers, the fracture lines in the articular end plates of the body and into the spaces of the spongiosa. The nucleus pulposus may be ruptured into the spinal canal.

Occupations. While the patients have been tabulated according to occupations (Table IV), one cannot draw any definite conclusion from these cases as to which occupations are more prone to produce accidents. First, this report includes cases occurring the years of prosperity, the years of depression, and the years of defense

Table IV
OCCUPATIONS

Laborer	27
Unskilled laborer	12
Driver	8
Student	12
Baker	2
Painter	8
Housework	22
Clerk	7
Salesman	3
Professional	4
Iron work and construction	3
Telephone repairman	1
Bricklayer	4
Steam fitter	5
Carpenter	1
Fireman	2
Letter carrier	1
Auto mechanic	1
Manufacturer	1
Elevator man	1
Dress maker and milliner	2
Weaver	1
Waitress	1
No occupation	18
Undetermined	13
Total	160

work, the trend of occupations changing constantly. Secondly, Fordham Hospital is not situated in a location where heavy industries, as steel making or mining, are carried on. The hospital is situated in the northern part of the Bronx, mostly a residential section. However, it covers an area of dense automobile traffic, hence many automobile accident cases are brought into the hospital. The occupation listed, therefore, may have very little to do with the injury.

Etiology—Direct and Indirect. A direct cause is any injury causing forcible hyperflexion of the spine or jacknifing of the spine, e.g., fall from a height, a blow from a heavy object falling on the shoulders, an automobile accident or a diving accident. Indirect causes may be a sudden uncoordinated demand on the muscles of the back as in a sudden turn of the trunk or by a misstep; violent contractures of

the extensor muscles of the back have led to fractures of the fourth and fifth lumbar vertebrae. (This was a frequent occurrence when metrazol was administered in dementia praecox.)

Table v

CAUSE	
Direct injury (including falls)	130
Indirect injury (including jumping)	17
Diving	8
Unknown	9

Table v gives the etiology of the fracture in its subdivisions. While we attempt to ascertain the history as to just how the injury was incurred, the information is not always reliable. Since so many are due to falls from windows or to automobile accidents, it is difficult to get a definite history as to whether the cause was direct or indirect.

Symptoms and Signs. Surprising as it may seem, some cases are not recognized because the patient is able to walk after the accident. Such patients are *x*-rayed a few days or weeks afterward mainly because they still complain of backache. The diagnosis of fracture of the spine is only then established.

The symptoms are: (1) shock in varying degrees; (2) pain in the involved portion of the spine and also referred to the chest or abdomen; (3) limitation of motion in all directions. (In sprains it is only in certain directions.) The limitation of motion is due to spasm. (4) Local tenderness of the spinous processes, better elicited by lateral pressure applied to the spinous processes; (5) abdominal distention, frequently follows compression fracture. It may be due to paralysis ileus. There may be marked abdominal rigidity closely simulating intra-abdominal injuries. (6) Bladder retention for a few days; (7) deformity—an angulation kyphosis is usually present at the level of the lesion (due to projection of the spinous process). In early cases, the kyphosis may be lacking. (8) Involvement of the cord: In a considerable number of cases, especially in fracture dislocation, the cord may be involved, giving partial or complete paralysis with loss of functions of the bladder and rectum. (Table vi.) (9) Later symptoms—Kümmels disease or post-traumatic kyphosis. In some cases, after a period of improvement, the patient develops pain and weakness of the spine. These are believed to be due to a rarefying osteitis.

Table vi
SYMPTOMS IN RELATION TO PARALYSIS

	No.	Per Cent
With paralysis	40	−25
Without paralysis	120	−75

Diagnosis. This should be made on the history of the injury, symptoms and *x*-ray findings. But if the *x*-ray is negative, another *x*-ray should be taken in ten days. Some cases are mild and may be missed. *X*-rays should include dorsal, lumbar and lumbosacral regions.

X-rays in Injuries of the Spine. The *x*-ray, of course, is the most important item both for diagnosis and for progress. The *x*-ray must be taken in the anteroposterior and lateral views. The latter is the more important one. Some suggest also an oblique view. The *x*-ray should be taken immediately, as soon as the patient reaches the hospital, before he is removed from the stretcher or blanket and without changing his position.

Prognosis. The prognosis depends upon the amount of injury to the spinal cord. If the cord is not involved and proper treatments are instituted early, the prognosis is good, though it may take one or two years. Occupations requiring a considerable amount of muscular stress or strain may be resumed only after careful consideration of all possibilities; some occupations naturally may never be resumed. Due to frequent medicolegal entanglements, the symptoms are usually exaggerated.

Death in fractures of the cervical region is due to shock and pressure upon the

medulla; in the upper dorsal to hypostatic pneumonias; in the lower dorsal and lumbar, to cystitis, pyelitis and exhaustion.

TREATMENT

There are various procedures. The one here reported is used by me at Fordham and Bronx Hospitals and also in my private practice. The results compare favorably with those obtained by other methods.

First Aid and Transportation. So many books have recently been written on transportation, and the cautions to be observed are described at such length, that it is unnecessary to discuss the problem here. It is mentioned only to emphasize the point that the damage of the cord is often caused by improper transportation and not by the trauma.

The rule to follow is, that if a fracture of the spine is suspected, the patient is rolled over on his face and abdomen into a blanket. When lifted, the back sags downward and thus removes pressure from the spinal cord. The arms are placed at the side and the head is turned to one side.

When the neck is broken, he is carried on a rigid board (four feet long and twelve inches wide) with the arms resting at the side and face upward. In the hospital the shock is treated first.

Direct Treatment of Cases without Paralysis. The patient is at once put on a Bradford hyperextended frame. The hyperextension is gradually increased daily with the turnbuckle.

Stookey and others suggest that the patient be put on an air or sponge mattress. However, I do not recommend such a mattress since I believe that on it the patient is disturbed too much when given a bedpan.

Many patients complain of abdominal distention from the very beginning. The distention and the discomfort are increased when the patient is placed on the hyperextended frame. Therefore, many surgeons hesitate to put on a plaster cast at once, but wait until the distention disappears; this takes a few days. The distention is usually due to paralysis ileus.

The patient remains on the frame for ten to fourteen days, until the abdomen is relaxed and the bladder and rectal functions are restored. Cornwell claims that if economic conditions permit, the patient should be kept on the frame for five to six weeks.

A plaster cast is then applied, using the Davis or Jones method or any device by which the patient can be held in hyperextension (best on the face) while the plaster is being applied.* The plaster cast extends from the suprasternal notch to just below the anterior superior iliac spines.

The cast is worn for eight weeks and then a brace, either of the Taylor or the Knight type with crutches under the arms, is put on. The patient gets physiotherapy while he wears the brace. The brace is left on till complete union occurs; this may take from eight to ten months. The intervertebral discs which are naturally disorganized by the trauma undergo replacement by fibrosis and become narrower even in the corrected cases. The general opinion of most surgeons is against such operations as spine fusion to hasten ankylosis.

Treatment of Fracture Dislocation of the Dorsal and Lumbar Spine Accompanying Compression Fracture. Placing the patient on the Bradford frame with traction and then hyperextension often reduces the dislocation. Subsequently it is treated by the same method as a compression fracture. (Table VII.)

Treatment of Compression Fracture with Cord Involvement (Paralysis). Contrary

* In Davis' method the patient's head is on a low level and the legs and feet are elevated. I use this in fractures of the lumbar region. In Jones' method, the pelvis with the legs rest on a low table, while the head and upper part of the spine are raised on a higher table. I follow this method in fractures of the upper and mid-dorsal. In both methods the patient is on the face suspended between two tables and the plaster jacket applied.

to the previous general opinions that laminectomy is indicated in these cases, most surgeons, and the neurological surgeons are here included, believe that there is nothing to be gained by immediate operation. In cases of a complete transverse lesion of the cord, operative interference can do no good. In cases of incomplete lesion in which there are indications for operation, it is more beneficial to wait two to three weeks. Later, nerve operations are indicated in cases of progressive symptoms and in which adhesions are present. All patients with injury to the cauda equina should be operated upon, since the nerves of cauda equina are capable of regeneration.

TABLE VII
METHODS OF TREATMENT

1. Bradford frame alone	23
2. Bradford frame and cast	39
3. Thomas collar and plaster	5
Brace following cast or collar	18
4. Plaster jacket alone	33
5. No treatment given except general care	18
6. Left or died before treatments were given	12
7. Other treatment: traction, collar or brace alone	11
8. Bone graft operation	2
9. Laminectomy	11

After 1918 every patient was placed on a Bradford frame. All these treatments are understood to include the frame. Most of the patients, on whom laminectomy was performed, came in the early years of these statistics. At that time, spine surgery was less highly developed than now.

Davis, in "Orthopedic Subjects,"[2] gives a careful discussion of the value of laminectomy in cases of partial or complete involvement of the spinal cord. "In cases in which complete paralysis is present, laminectomy is almost completely futile." He believes that "in affecting decompression, hyperextension, probably is as efficient as, if not more than laminectomy."*

Hopeless Paralysis from Fracture Dislocation. If after the first few days it is found that no recovery is taking place, and the patient shows signs of total paralysis at a definite level, and if there is incontinence of urine and feces, the principal problem is that of nursing care. It has been found that in order to prevent development of bedsores anterior and posterior shells should be made. These should be carefully molded to impress the soft parts and should avoid the bony prominences. Such shells should extend from the knees to the shoulder and suitable apertures should be made anteriorly and posteriorly. The shells should be strapped together with trunk straps and the whole ensemble should be mounted on a Bradford frame. The patient should be turned over two or three times a day, one shell being removed at a time in order to allow proper care of the skin. If the patient lives through the urinary complication, he may eventually be able to navigate with crutches or may spend the rest of his life in a wheel chair.

TABLE VIII
RESULTS ON LEAVING THE HOSPITAL

	No.	Percentage
1. Left before treatments were given	12	7.5
2. Died before treatments were given	10	6.3
3. Improved or cured	111	69.4
4. Not improved—transferred to Psychop	3	1.9
5. Died from general causes	7	4.3
6. Died after operation	9	5.6
7. Died from cystitis	5	3.1
8. Unknown	3	1.9

Treatment of Urinary Complications. Where there is retention, the urological surgeon should be consulted to decide the method of drainage, whether by suprapubic cystostomy or by allowing the bladder to become distended and thus produce an automatic bladder.

Table VIII gives my results obtained in this series of cases. The large number of fatalities after laminectomy is due to the fact that many patients in the earlier years of this group were subjected to this operation whereas later the neurologists and neurological surgeons would have

* Davis, in the book mentioned, gives an excellent résumé of the treatments. It was intended for army surgeons and it can be read with a great deal of profit by other surgeons.

hesitated to recommend such radical treatment or would have treated them conservatively.

Up to 1929 we operated upon nine patients with fatality in seven. From 1929 till 1943 only two laminectomies were performed and even those patients died.

CONCLUSIONS

1. Every case of injury to the spine should be examined with extreme care to rule out fracture.

2. Immediate rest should be instituted until the examination is completed.

3. Radiographs should be taken in three views: anteroposterior, lateral and oblique.

4. If the roentgenogram is negative but the symptoms point to a fracture, another roentgenogram should be made in a few days as it may show the lesion.

5. Diagnosis rests on history, localized pain and stiffness of the spine.

6. Prognosis depends on the amount of injury to the spinal cord. If the cord is not involved and proper treatments are instituted early, the prognosis is good.

7. Fractures of the laminae, transverse and spinous processes, articular processes, the ribs, the bones of the extremities especially the os calcis, are frequently present, and these complicate the prognosis and influence the treatment.

8. Treatment consists of rest on a Bradford frame in a hyperextended position, then a plaster jacket or two plaster shells, and finally a spinal brace.

9. The conservative treatment is attended by excellent results. Good function may sometimes occur after four to six months of protection by recumbency and plaster jacket, though full recovery may not be obtained for one to two years. An occupation, however, requiring a great deal of stress and strain may sometimes not be resumed.

10. Early operation is indicated when the *x*-ray shows dislocated bone pressing upon the spinal canal.

11. A patient with fresh fractures should rarely be subjected to operative interference. In cases of a complete transverse lesion of the cord, operative interference can do no good. In cases of incomplete lesion in which there are indications for operation, it is more beneficial to wait two to three weeks. Later nerve operations are indicated in cases of progressive symptoms and when adhesions are present.

12. All patients having injury to the cauda equina should be operated upon, since the nerves of the cauda equina are capable of regeneration.

13. In late cases in which pain still exists, nature has not ankylosed the injured region of the spine and if patient wants to return to strenuous back-bending labor, ankylosing operations should be considered. Time is likely to be saved thereby and the patient permitted to labor without apprehension. The experience of the compensation companies however, is that these cases are worse off after the operation than before. Evidently the legal element is a factor.

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MARCH (FATIGUE) FRACTURES OF THE LONG BONES OF THE LOWER EXTREMITY AND PELVIS*

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MARCH fractures or "fatigue" fractures of the long bones of the lower extremity and pelvis are frequently overlooked. It is chiefly an occupational disease of military life, associated with intense military training. The incidence is low. In a nine-month period from September 1, 1943, to May 30, 1944, 10,953 orthopedic cases were seen at an Army Station Hospital. Of this number twelve march fractures of the long bones and pelvis were encountered.

The bones involved, in order of their frequency, were the tibia in six cases, the pelvis in three cases, the femur in two cases (one involving the lower one-third and one involving the neck), and the fibula in one case.

ETIOLOGY

All fractures of the march type are characterized by solution of continuity without obvious, single violence. The onset is insidious, and a long period of time elapses before the patient presents himself for treatment. The inexperienced medical officer frequently attributes the soldier's complaint to muscle strain, myositis, tenosynovitis or bursitis.

This condition has been described under various names: Pseudofracture, such as the case described by Weaver and Francisco who maintained that the condition was "a manifestation of non-suppurative osteomyelitis," insufficiency fracture, "umbauzone," wear-and-tear fracture, exhaustion fracture (Henschell), insidious or overload fracture, callous tumor, etc. George Brandt, of Mainz, wrote about a "creeping fracture," which described one of the characteristics of this type of fracture but did not give any clue to its etiology.

Branch suggests that the fracture in the tibia is due to the upward swing of the leg and the resultant backward stress on the supporting leg during rigid marching. In the fibula he believes the fracture to be due to repeated minor traumas. This, he claims, is frequently seen in artillery men jumping off and on caissons and in ice skaters due to strain. In the femoral shaft it is his belief that it is due to running in a crouched position or due to the strain of marching with full field pack, with the added factor of the rotary mechanism of the hip joint and the action of the hip muscles.

Wilhelm, in 1940, attributed the pubic fracture to the antagonistic action of the abductors and adductors of the hip in forced and long marches.

The author agrees with Camp and McCullough and Hamilton and Finklestein that march fracture of the lower extremity and pelvis is merely the response of the weight-bearing skeletal frame to continuous overstrain. The exact mechanism for the strain, fatigue, stress, or march fracture is unknown. For example, no explanation has been offered for the characteristic predilection of the site of these fractures. Tibias are usually fractured about three inches distal to the joint line; fibulas generally fracture in the upper third or at the lower end; femora are usually involved about three inches above the joint line or at the neck. It is the writer's belief that just as in metatarsal march fractures, in which fatigue of the

* The data offered in this paper represent the author's experience in an Army Station Hospital while chief of the Orthopedic Section.

peroneus longus and tibialis posticus is an important etiological factor, so the fatigue or imbalance of muscles in the long bones of the extremities and pelvis is an important causative factor.

MARCH FRACTURES OF THE TIBIA

March fractures of the tibia are the most common of all march fractures of the lower extremity and pelvis except metatarsal march fractures.

Clinical Features. The patient is usually a well developed male in good general health. In six march fractures of the tibia, three occurred in trainees eighteen years of age and three in trainees nineteen years of age. The periods of complaint of pain in the leg before the patients were hospitalized were seventy days, forty-five days, three cases of thirty days, and one of fourteen days, respectively. The length of military service in these patients was two months in one case, three months in two cases, and four months in three cases. The right and left tibias were involved in three cases each. Early in the history of the case there is generally vague pain, chiefly referred to the knee with muscle tenderness, stiffness, and bone tenderness in the upper third of the medial aspect. Later there is swelling with pitting edema and some increased heat and rubor. All motions of the knee joint are painless. Weight-bearing increases pain. In some cases the pain may be severe enough to disturb the soldier's sleep.

X-ray may be negative in the early stages. Later there is commonly some periosteal thickening on the medial and posterior aspect, at the junction of the upper and middle thirds of the tibia. The fracture then tends to spread thoroughout the diameter of the bone as a crack in ice would spread. The callus becomes greater in amount, but is never very excessive. In older cases the *x*-ray shows a zone of increased density in the area of fracture. There is usually no displacement. The fracture of the tibia may look insignificant and the patient may be returned to duty prematurely. This happened in Case IV. This soldier was admitted to the hospital January 31, 1944, with *x*-ray evidence of periosteal thickening without fracture line. He was placed on a non-weight bearing regimé until March 5, 1944. During the absence on leave of the author, a subordinate medical officer permitted this patient to join the reconditioning program. While playing ball the soldier ran and fractured the tibia and fibula. The resultant fracture showed angulation, requiring closed reduction and the application of a cast.

Treatment. Complete bed rest without weight bearing is permitted in cooperative patients. These "ice crack" fractures show no tendency to displacement if weight bearing is not permitted. This non-weight-bearing regimé is carried out for eight to twelve weeks, after which rehabilitation is undertaken. Physiotherapy, dry heat, and massage are prescribed, and active and passive exercises are encouraged. It is the writer's belief that this form of treatment is preferable to plaster immobilization, as there is no problem of rehabilitating a stiffened knee or ankle, due to the fact that motion in these joints is encouraged early. There is also less atrophy of disuse in the muscles of the limb.

REPORTS

Case I. The patient, age nineteen, a farmer in civilian life, stated that he developed a slight ache in the knees after four or five marches, and had no other complaint until he went on a forced march the day before admission which caused pain in the knee, leg and ankle which was severe enough to disturb his sleep that night. On examination, the soldier was a well nourished young adult, not appearing acutely ill, but walking with a slight limp. Complete physical examination was essentially negative except for increased heat over the middle of the right tibia and tenderness, most marked in the region of the upper and middle thirds. *X*-rays taken on April 3rd showed no evidence of march fracture. On April 10, 1944, there was slight subperiosteal calcification along the posterior and medial aspect of the upper

third of the right tibial shaft suggesting a march fracture. A march fracture was suggested. On April 18th, the roentgenologist reported. "The subperiosteal calcification of the upper shaft of the tibia has increased in amount in the past week. No definite fracture line is evident. The appearance, however, suggests a march fracture." On June 7, 1944, the *x*-ray report read, "There is early bony callus at the site of fracture of the upper tibial shaft." (Fig. 1.)

Fig. 1. Case 1, march fracture, right tibia.

Case II. This patient, age eighteen, a former office boy, entered the hospital with the complaint of pain in the left knee. He stated that about a month previously, while on a forced march, he developed pain in this region. This pain was referred to the ankle and was increased by carrying a pack. At first he paid little attention to the pain, but as it became gradually worse he reported to the dispensary. Since the initial appearance of his complaint he had made a number of marches, each of which caused the pain to increase. Examination was negative except for slight swelling on the medial aspect of the upper third of the left tibia with point tenderness in this area. *X*-ray showed subperiosteal calcification of the posterior and medial aspect of the upper shaft of the left tibia. No definite fracture was seen, but there was a zone of increased density through the shaft at this point. The diagnosis was march fracture of the tibia. (Fig. 2.)

Case III. The patient, age nineteen, a former farmer, inducted into the army on September 30, 1943, stated that on December 27, 1943, while marching back from a night problem, he developed pain in his left knee and in the upper third of the lower leg. He reported to the dispensary two days later and was given a liniment and returned to duty. On January 3,

1944, while in the field taking combat training, the pain became so severe that he was unable to continue. On January 8th, he was hospitalized. On examination there was marked tenderness about three inches below the joint line over the left tibia with some localized rubor and tenderness. *X*-ray showed a break through the cortex of the left tibia three inches below the articular surface. Very slight callus was present. On January 31st the recheck *x*-ray showed moderate callus present. This patient was treated with bed rest and local heat for pain, and after four or five days he had no further complaint. (Fig. 3.)

Fig. 2. Case II, march fracture, left tibia.

Case IV. The patient, nineteen years of age, a truck driver in civilian life, stated that on January 1, 1944, while on a fourteen-mile forced march he noted sharp pain in the upper third of the left leg. This area was tender to touch. The pain became severe, but he continued his march. The following day he went on another hike, but had to fall out because of the severity of the pain. He was sent back to the barracks where he did light duty for about two weeks. As the condition became worse, he was sent to the hospital on January 28th for *x*-ray and was hospitalized on January 31st. Examination revealed no swelling, but there was marked point tenderness over the medial aspect of the upper third of the left tibia. *X*-ray showed subperiosteal thickening of the medial and posterior aspect at the junction of the upper and middle thirds of the left tibia. (Fig. 4.) On March 4th the soldier was transferred to the reconditioning ward. Two days later, while playing ball, he ran and his left leg gave way. There was some deformity and swelling in the region of the old march fracture. An *x*-ray revealed a complete, simple fracture of the left tibia through the march fracture site and also a fracture of the fibula. (Fig. 5.) The tibia was manipulated and immobilized in a plaster of paris cast, with the fracture in good position.

Case V. The patient, eighteen years old, a musician in civilian life, was inducted into the army July 24, 1943, and stated that after a forced march in October he developed pain in the right leg. This pain was not very severe in character and so he did not report on sick call. Seventy days later, while on bivouac, pain recurred. The dispensary officer sent him to the hospital for *x*-ray on December 22nd. The *x*-ray revealed subperiosteal thickening along the inner and posterior aspect of the shaft of the tibia; no fracture line was visible. On examination there was slight swelling and tenderness over the middle third of the shaft of the tibia. Routine blood and urine examinations were negative. On a regimé of bed rest and local heat the soldier made an uneventful recovery, and at no time demonstrated complete fracture. The *x*-ray report of March 6th was as follows: "Right leg, there is a thickening of the cortex

along the inner and posterior aspect of the shaft of the tibia about six inches above the ankle joint, the result of an old well healed march fracture."

Fig. 3. Case III, march fracture, left tibia.

Comment. Although the fracture in this case was not in the typical location for a march fracture of the tibia, and although no fracture line with condensation of bone developed, I believe this man had a march fracture of the tibia, but due to the bed rest regimé and the removal of weight bearing, the process was aborted.

Case VI. This soldier, age eighteen, while running the obstacle course on January 22, 1944, experienced dull pain in the upper third of the right leg. That night he noticed sharp pain in the leg, and the anterior upper third became swollen and tender. The following morning he reported to the dispensary and was given a liniment to rub on the leg, but the pain persisted. His leg was painful on walking, but after four weeks the pain had almost completely subsided. The patient noted, however, that if he stood on his right leg and turned to the right, he would again have pain in the upper third of the leg. He also noted that walking over uneven terrain would cause distress. Two weeks prior to hospitalization the condition became more severe and he again went to the dispensary. This time he was sent to the hospital for *x*-ray, but was returned to full duty. On March 6th, while standing on the combat range talking to a fellow soldier, he was given a shove and experienced sharp pain in the right leg. This was so severe that he was hospitalized. Complete physical examination was negative except for diffuse swelling on the anterior and medial surfaces of the upper third of the right leg. There was increased heat and marked point tenderness three inches below the joint line. *X*-ray taken on March 8th revealed a march fracture through the shaft of the tibia about three inches below the knee joint with a moderate amount of callus at the fracture site. With bed rest the pain subsided rapidly, and the soldier made an uneventful recovery without disability.

MARCH FRACTURE OF THE FIBULA

One case of march fracture of the fibula was encountered. This fracture has a predilection for two areas, one in the upper third of the fibula and the other just above the tibiofibular joint. The case the upper third of the fibula and the other just above the tibiofibular joint. The case described by Weaver and Francisco was undoubtedly one of this type. Hamilton and Finklestein described a march fracture of the lower end of the fibula occurring bilaterally.

Case VII. This soldier, age nineteen, a former switchman, complained of pain in the left lower leg for about two weeks prior to admission to the hospital. It was characterized by cramping of the muscles of the leg and foot. The soldier denied any injury to the leg. He had completed ten weeks of his seventeen-week basic training cycle. At no time had he ever fallen out of a march. Long or forced marches increased the pain. Two days prior to hospitalization the soldier was not able to stand on his foot on getting out of bed and required help to walk to the dispensary. Physical examination showed a tall, robust, young male in no acute pain or distress. The left leg was swollen and tender and was a half inch greater in circumference than the right leg at the level of the

calf muscles. There was tenderness on palpation but no edema. The *x*-ray report of April 7, 1944, read: "There is a small area of subperiosteal calcification along the medial

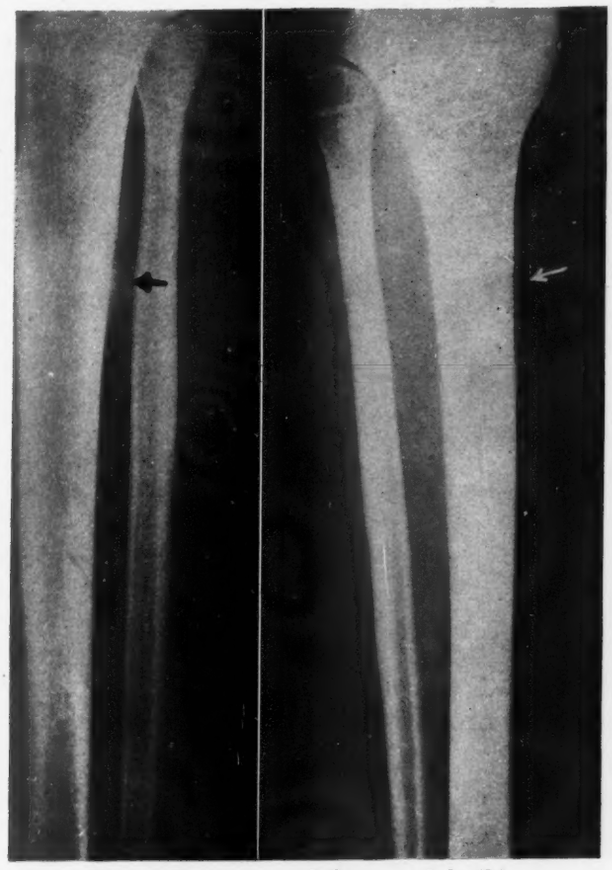

Fig. 4. Case IV, march fracture, left tibia.

aspect of the left shaft of the fibula. This change is also seen posteriorly and to a lesser degree on the lateral aspect." The roentgenologist at that time stated, "This may represent an early march fracture, although the location is somewhat against it." On April 18th the *x*-ray report read, "There is a well defined hairline fracture through the mid-shaft of the fibula with bone condensation along the fracture line and with considerable callus at this site. The appearance is that of a march fracture." The report of May 11, 1944, stated, "The fracture line is not visible at this examination, but there is an increase in the callus about the march fracture of the mid-fibula." (Fig. 6.) With bed rest and without immobilization the pain and swelling subsided quickly, and an uneventful recovery was made, and the soldier was discharged to duty.

MARCH FRACTURES OF THE FEMUR

March fractures of the femur occur at two common sites: the neck, and the shaft, about three inches above the joint line. Two cases are herein reported, one involving the neck of the right femur in a thirty-one-year-old soldier, and one involving the lower third of the right femur in an eighteen-year-old soldier. The history is usually of an insidious character, frequently overlooked by medical officers who are not acutely aware of this condition. The period of time between the initial complaint and hospitalization was three weeks and one month, respectively.

Treatment. Fractures of the lower end of the femur are treated by bed rest and the avoidance of weight bearing, as these "ice crack" fractures show no tendency to displacement. This regimé is more satis-

factory because rehabilitation is greatly facilitated by the lack of stiffness of the joints and the absence of atrophy of disuse of the muscles.

FIG. 5. Case IV, fracture through site of march fracture.

In fractures of the neck of the femur the application of a plaster double spica cast is indicated, as there is a tendency to coxa vara deformity. Branch reported the use of a three-flanged nail in one of his cases and the necessity for a high intertrochanteric osteotomy for a case of non-union.

CASE VIII. This soldier, age eighteen, stated that one month prior to hospitalization he began to have soreness of the muscles above the right knee. He reported to the dispensary on one occasion and was told to apply hot towels. This gave no relief. The pain seemed to radiate down into the lower part of his leg. He fell out of none of his marches prior to this complaint. On December 15, 1943, he started on a forced march, but had to fall out because of pain. He again reported to the dispensary and was sent to the hospital for *x*-ray. That same day he made a fifteen-mile hike. He could hardly make it because of the severe pain. On December 20th he went through the infiltration course and stayed on duty until he was admitted to the hospital. The *x*-ray showed a typical march fracture about three inches proximal to the joint line with condensation along the fracture site. (Fig. 7.)

CASE IX. This soldier, age thirty-one, had been a lumber camp worker. He was inducted August 10, 1943. Three weeks prior to hospitalization this soldier began to have severe pain in the right hip. There was no history of injury. The following day he reported to the dispensary but was sent back to duty. The next day he reported on sick call again, was placed on quarters status for two days, and was again sent back to duty. Lying down would relieve the pain, but on putting weight on the leg, the pain was severe. As he could not do full duty, he was given light duty. On December 22, 1943, an *x*-ray of the hip was made and the soldier was admitted to the hospital. The *x*-ray showed a fracture of the neck of the femur one-half inch above the intertrochanteric line with the fragments in good position. (Fig. 8.) On January 26th a double spica cast was applied, with the leg in abduction. On February 23, 1944, a moderate amount of bony healing had taken place, but there was slight coxa vara present. After eight weeks in the cast, it was bivalved and the posterior half was used at night and physiotherapy was instituted. No further deformity in the region of the fracture occurred, and the soldier made an uneventful recovery.

MARCH FRACTURES OF THE PELVIS

Three cases of march fractures of the pelvis are herein recorded. These cases occurred in soldiers twenty-three, thirty-four, and thirty-six years of age, respectively. The periods that elapsed between initial complaint and hospitalization were seven weeks in one case, and six weeks each in the remaining two cases. This fracture has a predilection for the inferior ramus of the pubis. The early *x*-ray shows characteristic "fluffy" callus which may exhibit cystic areas, giving rise to the appearance of a bone tumor. There is no tendency for the fragments to displace. The treatment consists of bed rest until the spasm of the adductor muscle group subsides, followed by limited activity for a period of two months before returning the soldier to full duty. As the discomfort

after a short period of bed rest is minimal, soldiers are placed on the reconditioning program after two or three weeks.

soreness, stiffness, and pain in the left groin. The day before hospitalization this soldier had made a twenty-mile hike. This march was ac-

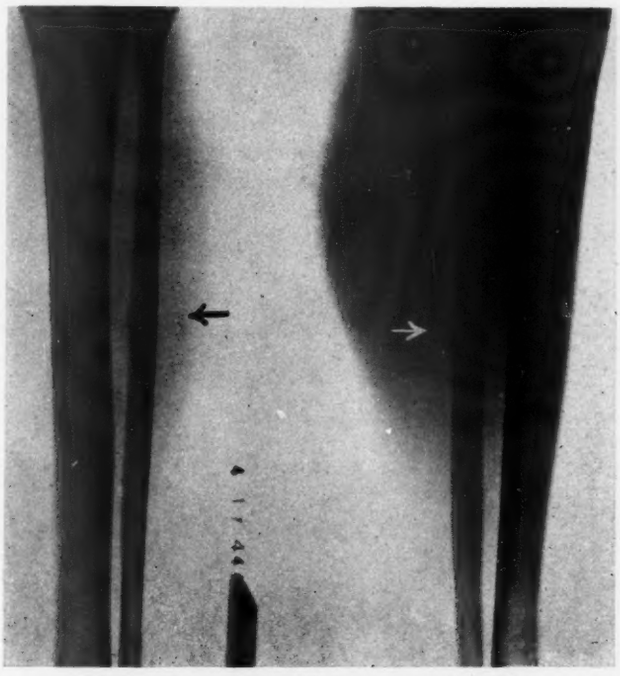

Fig. 6. Case vii, march fracture, left fibula.

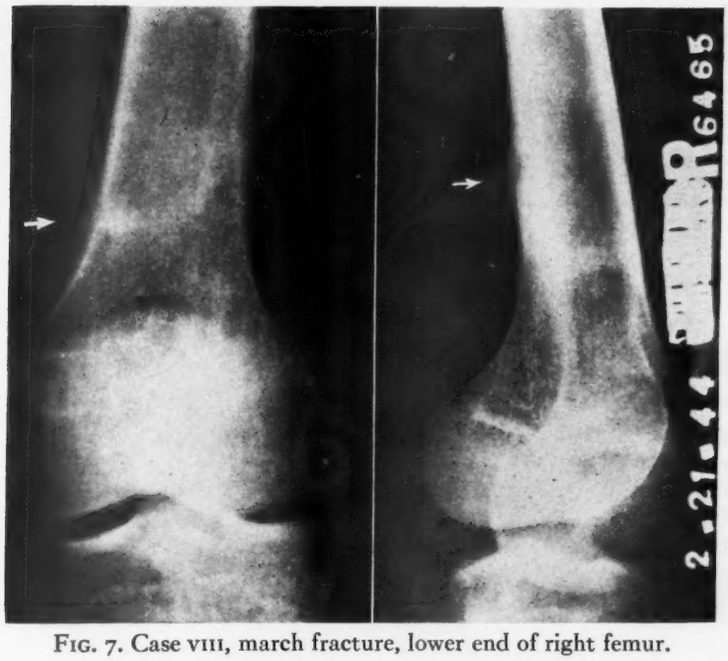

Fig. 7. Case viii, march fracture, lower end of right femur.

Case x. This soldier, age thirty-four, was inducted into the army January 13, 1944. He had been a meat cutter. He complained of pain in the left groin, and stated that about six weeks prior to hospitalization he developed

companied by marked, but not unbearable pain. When he reported to the dispensary the diagnosis of adductor myositis was made, and he was placed on light duty. As a result, the pain subsided. At the time of hospitalization

FIG. 8. Case IX, march fracture, neck of femur, right.

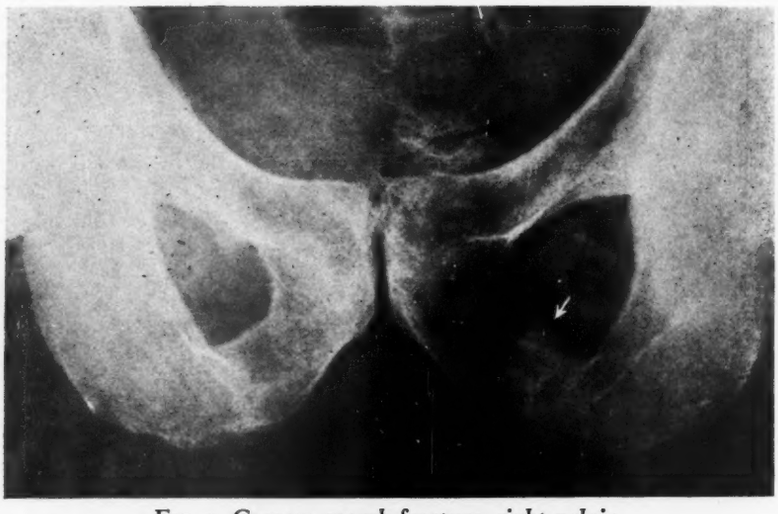

FIG. 9. Case XI, march fracture, right pelvis.

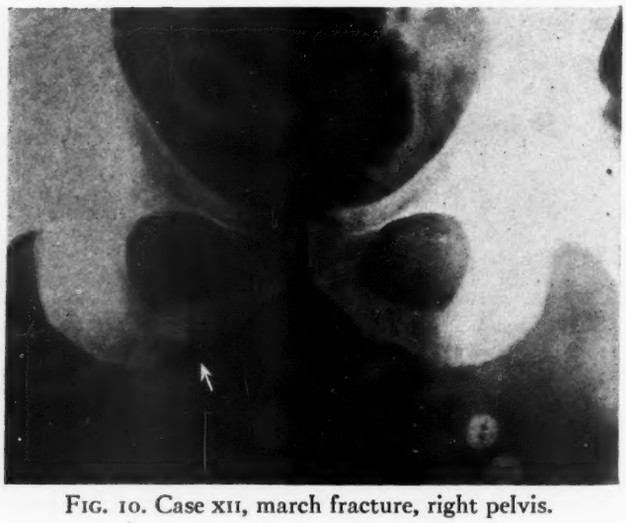

FIG. 10. Case XII, march fracture, right pelvis.

he was in his fourteenth week of his seventeen-week training cycle. The soldier was unable to recall any specific incident that might have caused the above complaint. Examination was essentially negative except for some tenderness over the pubic ramus. There was no muscle spasm, and all motions of the left hip were normal. *X*-ray showed a fracture of the inferior ramus of the pubis with a faint band of increased density throughout the bone. After two weeks' bed rest the soldier had no further complaint and was sent to the reconditioning ward and made an uneventful recovery.

Case xi. A twenty-three-year-old soldier, a soda fountain attendant in civilian life, complained of pain in the right groin. This occurred while running over the obstacle course six weeks prior to hospitalization. Pain was aggravated by walking and jumping. At the time of injury he was in the fifteenth week of his seventeen-week training cycle and had been able to make all his hikes and marches. Physical examination was essentially negative. He was a well developed male in no acute pain and had localized tenderness over the right pubic bone, with some muscle spasm in the adductor group. All motions of the right hip were free and painless. *X*-ray of May 12, 1944, revealed a fracture through the inferior ramus of the pubis with a small amount of callus at the fracture site. (Fig. 9.)

Case xii. A thirty-six-year-old soldier, inducted into the army November 26, 1943, was a waiter in civilian life. He stated that on or about February 1, 1944, while digging a fox hole, he developed pain in the right groin. This was not severe, and he was able to complete his task. For the next two weeks he continued to train with his company. The pain became more intense daily, and when he was unable to go over the obstacle course, he was told to report to the dispensary. At the time of injury this soldier was in the eleventh week of his training cycle. Physical examination revealed a small, well developed male, in no acute pain. There was some muscle spasm in the adductor group; all motions of the hip were normal except adduction of the thigh, which was painful. *X*-rays on March 10, 1944, revealed an early march fracture through the junction of the right inferior ramus of the pubis and ischium with a slight amount of callus at the fracture site. (Fig. 10.) On April 4th, there was a moderate amount of callus. After three weeks' bed rest, the soldier was placed on the reconditioning program and made an uneventful recovery.

SUMMARY

1. March or "fatigue" fracture is primarily an occupational disease associated with military training.

2. Because of the insidious nature of the disease, many cases of march fracture are overlooked by the uninitiated.

3. Etiology is obscure, but the author believes, as in cases of march fracture of the metatarsals, that it is due to muscle fatigue or muscle imbalance.

4. March fractures occur in specific areas of predilection.

5. *X*-ray appearance is that of an "ice crack" fracture.

6. Displacement of fragments is unusual except in the case of fracture of the neck of the femur, where, if the fracture is not protected from weight bearing, coxa vara commonly occurs.

7. March fractures, even if incomplete and not of striking *x*-ray appearance, must be treated with great respect, and too early weight bearing should be prohibited.

8. Ideal treatment of march fractures of lower extremity and pelvis is bed rest and prohibition of early weight bearing. In fractures of the neck of the femur, immobilization is indicated.

9. No case of delayed or non-union was encountered.

10. In 10,953 orthopedic cases seen in a period of nine months at an Army Station Hospital, twelve cases of march fracture of lower extremity and pelvis, excluding metatarsal march fractures, were encountered.

11. Case histories of six march fractures of the tibia, one of the fibula, two of the femur, and three of the pelvis were reported.

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PENICILLIN THERAPY AS AN ADJUNCT TO GENITOURINARY SURGERY*

REPORT OF ELEVEN CASES

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IN surgical interventions on the genitourinary organs control of infection is of the utmost importance. A successful outcome depends not only upon judicious choice, well timed application and skillful execution of the operative procedure, but also upon minimizing infection. Penicillin offers us a potent antibiotic which has proven far superior to the other chemotherapeutic agents now at our command. We have employed it in a sufficient number of surgical cases to justify our opinion that it is a valuable adjunct in the prophylaxis and treatment of infection. It destroys susceptible organisms invading the genitourinary tract, general circulation and operative wounds. The many cases of venereal infection which responded rapidly to penicillin therapy will not be discussed in this communication, because surgical intervention was not a part of their treatment.

Until recently, in civil practice the availability of penicillin has been limited. However, we have been able to secure an adequate quantity for use as an adjunct to the surgical treatment of hypertrophy of the prostate, perinephritic abscess and cortical abscess formation of the kidney. We have also employed it for the relief of acute exacerbations of chronic pyelonephritis, attacks of secondary infection associated with tuberculosis of an acquired solitary kidney, and encrusted cystitis associated with bladder diverticulum. In our hands it has been very effective in the preliminary management of patients presenting overwhelming infection of the genitourinary organs for whom operation was contemplated. Lately, the compound has become more plentiful, and we are employing it in a greater number of operative cases as a prophylactic measure against infection. Penicillin is equally valuable as a curative agent when infection has developed after operation. The material has the advantage of being nontoxic and rapid in action; in the aged prostatic who is usually intolerant to sulfatherapy, it is often a life-saving measure. Its importance is enhanced by its bacteriolytic effect on staphylococci, which have proven refractory to sulfatherapy. Although it is a powerful weapon in combating infections of the genitourinary organs, it should be considered only in conjunction with adequate surgical intervention such as drainage of pus and operation for relief of encapsulated infection.

CASE REPORTS

CASE 1. No. 107402. R. D., aged eighty-four, entered St. Mary's Hospital, August 13, 1944, for relief of complete urinary retention due to hypertrophy of the prostate. The patient presented coronary disease and advanced urinary infection; the offending organisms were Gram-positive cocci and diplococci and Gram-negative bacilli. Medical supervision was carried out by Dr. S. P. Lucia. On September 13th, suprapubic prostatectomy was performed, and a trilobar gland weighing 140 Gm. was removed. Following operation, mild wound infection and marked psychosis developed. A

* From the Departments of Urology, St. Mary's, French and Southern Pacific General Hospitals, San Francisco, California. Presented in part at the staff meetings of Southern Pacific General Hospital, December 16, 1944, and St. Mary's Hospital, January 19, 1945.

total of 3,000,000 units of penicillin was administered by intermittent intragluteal injection. On the day following institution of penicillin therapy, the general well being of the patient was improved and psychic symptoms had disappeared. Wound infection rapidly subsided, and urine gradually cleared; on September 25, culture revealed the presence of only Gram-negative bacilli.

Case II. No. 123580. M. S., aged seventy-three, entered St. Mary's Hospital, December 16, 1944, for relief of complete retention due to hypertrophy of the prostate. The patient presented marked debility, coronary disease and azotemia. Back pressure on the kidneys was relieved by indwelling catheter drainage for two weeks. On December 29th, a trilobar adenoma weighing 32 Gm. was removed by suprapubic prostatectomy. On December 31st, pneumonia and severe mixed urinary infection developed, accompanied by high fever (104.2°F.). Penicillin therapy was instituted; a total of 3,000,000 units was given intragluteally. Pneumonia rapidly resolved and the urine gradually became clear. On January 2, 1945, suppurative orchiepididymitis appeared, which required drainage. It is interesting to note that in the pus obtained from this abscess only Gram-negative bacilli were recovered.

Case III. No. 109860X. J. C., aged sixty-five, entered St. Mary's Hospital, December 26, 1944, for relief of complete retention due to collar-type hypertrophy of the prostate. Transurethral resection had been carried out five years previously, resulting in relief of symptoms to the present time. Overwhelming infection due to Streptococcus faecalis and Gram-negative bacilli caused added swelling of the remaining portion of the prostate, blocking the neck of the bladder. Infection was favored by a vesical diverticulum. At time of cystoscopy, January 2, 1945, Gram-positive cocci and diplococci and Gram-negative bacilli were recovered. Penicillin therapy was instituted one week before operation to control infection and prevent dissemination during intervention; a total of 2,000,000 units was given intragluteally. On January 11th, transurethral resection was carried out; the channel formerly made between the trigone and verumontanum was widened. The patient returned home relieved of symptoms of prostatism. A significant observation is that on the day of operation culture revealed Gram-negative bacilli only; the cocci which were playing an important rôle in this case had been entirely destroyed by preoperative administration of penicillin.

Case IV. No. 122984. E. C., aged forty-eight, entered St. Mary's Hospital, December 12, 1944, for relief of partial retention (residual urine 150 cc.) due to infected prostatic hypertrophy. Azotemia and advanced coronary disease were present. Medical supervision was carried out by Dr. A. P. Diepenbrock. Before hospitalization, after a long period of preparation by intermittent catheterization and sulfatherapy, transurethral resection was carried out on December 13th. Thirteen days later, overwhelming infection of the urinary tract developed, characterized by febrile reaction, frequency, etc. Offending organisms were Gram-positive cocci, Streptococcus faecalis and Escherichia coli. A total of 2,000,000 units of penicillin was administered intragluteally. Symptoms of prostatism subsided and the urine cleared gradually. The patient is still under medical care for coronary disease.

Case V. No. 60028. P. P., aged sixty-five, entered French Hospital, January 2, 1945, for relief of complete retention due to hypertrophy of the prostate. Pronounced mixed urinary infection was present, including Trichomonas vaginalis. The urine was so turbid and filled with mucus that it blocked the retention catheter, which had to be changed at frequent intervals. After twenty-five days of preparation by continuous catheter drainage, azotemia was controlled sufficiently to permit operation. Suprapublic prostatectomy was carried out on January 27th, and a trilobar prostate weighing 125 Gm. was extirpated. A few days before, intragluteal penicillin therapy had been instituted for the purpose of controlling infection; 2,400,000 units were given in all. The patient made a smooth convalescence. On February 24th, four weeks after operation, the urine was entirely clear, contained no pus and was negative to culture.

Case VI. No. 29417. J. J., aged fifty-five, entered Southern Pacific General Hospital, January 19, 1945, for relief of retention due to hypertrophy of the prostate complicated by prostatic calculi. Many years ago, a bladder stone had been removed by cystolithotomy. Patient was a good risk, and presented only mild infection of the urinary tract. After preparation by intermittent catheterization,

suprapubic prostatectomy was carried out on January 31, 1945. Considerable pericystitis was encountered, and collar-type hypertrophy containing stones was found to be quite adherent on enucleation. During operation, the peritoneum was accidentally opened and infected urine flowed into the peritoneal cavity. The tear was closed by suturing it to the bladder wall with interrupted catgut sutures. Penicillin therapy was immediately instituted as a prophylactic measure against infection of the abdominal cavity; a total of 1,000,000 units was given intragluteally. The patient made an uneventful recovery; there were no signs or symptoms of peritonitis.

Case vii. No. 45449. L. S., aged sixty, entered Southern Pacific General Hospital, February 12, 1944, for relief of complete retention due to hypertrophy of the prostate complicated by bladder stones. The patient presented marked debility, anemia, azotemia and advanced infection of the urinary tract. Back pressure on the kidneys was relieved by indwelling catheter drainage for two and one-half weeks. Intravenous urography revealed advanced hydronephrosis of the left kidney, as well as back pressure changes in the right kidney. Culture prior to operation yielded Escherichia coli. Two transfusions were administered. On February 26th, the trilobar prostate and twenty bladder stones were removed through a suprapublic incision. Intragluteal penicillin therapy had been instituted three days prior to operation, and was continued until 3,000,000 units had been given. In spite of the advanced infection which had been present, the wound healed per primam and the patient, a poor risk indeed, made a good recovery.

Case viii. No. 87612. A. H., aged forty-two, entered Southern Pacific General Hospital, December 25, 1944, for relief of advanced infection of the right kidney. On April 21st, a large stone had been removed from this organ by pyelolithotomy. Operation was rendered extremely difficult by the high position of the kidney; this organ was almost entirely intrathoracic. Urologic examination revealed multiple cortical abscesses of the right kidney complicated by perinephritic abscess. Sulfatherapy was given a term of trial with no effect. Two days prior to surgical intervention intragluteal penicillin therapy was instituted with the object of precluding diffusion of infection. Two million units in all were given. On December 30th, the perinephritic abscess was drained, and the kidney removed by subcapsular nephrectomy. Culture of perinephritic and kidney abscesses revealed Staphylococcus aureus and Escherichia coli. The wound was thoroughly lavaged with saline solution and sprinkled with 4 Gm. of sulfonamide crystals. The patient made an uneventful recovery, temperature returning to normal the second day after operation. The wound, in which a drain had been placed in the upper and lower ends, healed per primam.

Case ix. No. 85496. R. M., aged forty-five, had repeated admissions to Southern Pacific General Hospital for treatment of tuberculosis of a solitary left kidney and the bladder, accompanied by secondary infection. The patient had undergone right epididymectomy for tuberculosis in 1932, left orchiectomy for tuberculosis in 1939; and right nephrectomy for tuberculosis in 1939. Febrile attacks responded slowly to treatment consisting of dilatation of the ureter, kidney lavage and administration of urinary antiseptics including sulfonamides. At the time of the last attack, November 4, 1944, intramuscular penicillin therapy was instituted in place of sulfatherapy. Symptoms subsided much more rapidly than on previous occasions; furthermore, there has been no recurrence since the administration of 3,000,000 units.

Case x. No. 84243. B. C., aged fifty-nine, had had several entries into Southern Pacific General Hospital for treatment of recurrent acute episodes of chronic bilateral pyelonephritis. Urologic study in August, 1944, revealed bilateral infected hydronephrosis, ureteral stricture, cystitis and papilloma at the base of the bladder. Offending organisms were Escherichia coli, Gram-positive diplococci and short-chain streptococci. A bladder tumor was destroyed by fulguration. Infection of the kidneys was treated by dilatation of the ureters and kidney lavage, and the patient was placed on several alternate courses of sulfa and mandelic acid therapy. Beginning September 4th, three million units of penicillin were administered intragluteally. Following this, the urine became clearer and the patient greatly improved. Recheck examination on February 26, 1945, showed infection still present in the right kidney. Pyelograms re-

vealed a pressure defect probably due to abscess formation. Surgical drainage, or even nephrectomy, may be necessary in this case. At the time of intervention we propose to employ penicillin in order to prevent dissemination of infection.

Case xi. No. 88426. W. J., aged sixty-three, entered Southern Pacific General Hospital, February 20, 1945. He was referred by Dr. H. E. Rogers, of El Paso, Texas, for treatment of a bladder diverticulum accompanied by encrusted cystitis. Cystoscopic examination revealed advanced cystitis presenting numerous incrustations and hemorrhagic areas and a large diverticulum of the bladder. Urine was highly alkaline (hydrogen ion concentration 7), and culture revealed Escherichia coli and Staphylococcus aureus. Preoperative intermittent intragluteal penicillin therapy was instituted (2,000,000 units in all), and rapid improvement ensued. The urine cleared, and the patient felt so well that he refused operation. Before discharge from the hospital, recheck cystoscopy showed great improvement in the condition of the bladder; incrustations and hemorrhagic areas had disappeared, and the kidneys were free of infection.

COMMENT

Eleven cases are reported in which penicillin therapy was utilized as an adjunct to genitourinary surgery. Organisms commonly found in infections of the genitourinary organs and of surgical wounds are the various cocci; these often exist in symbiosis with bacilli. In the cases under discussion, organisms destroyed by penicillin were Gram-negative and positive cocci and diplococci, and Gram-positive bacilli; viz. Staphylococcus aureus, Streptococcus faecalis and Trichomonas vaginalis. Pyogens that constantly resisted penicillin therapy were Escherichia coli and other Gram-negative bacilli. However, the compound was highly effective in cases presenting overwhelming mixed infection in which these organisms participated, the urine usually having been rendered sterile at the end of four weeks.

The resistance of bacterial species to penicillin is relative, the different strains exhibiting varying degrees of susceptibility. Perhaps the discouraging reports concerning the therapeutic merit of penicillin in mixed infections will be modified by purer extracts, greater dosages, higher concentrations and more specialized culture methods which will reveal elusive anaerobes and other organisms Perhaps, also, more precise information will be forthcoming concerning that phase of bacterial growth at which the mold exerts its greatest lytic effect. According to Todd, this is the stage at which most rapid multiplication of organisms occurs; delayed growth antagonizes the effect. This would account for the success obtained in the so-called prophylactic attack against penicillin sensitive organisms, and likewise for the therapeutic effectiveness of penicillin in early acute infections (young cultures).

Streptococcus faecalis is an enterococcus, or thermophilic form of non-hemolytic streptococcus,[9] which investigators have been in accord in declaring to be penicillin resistant. Helmholz and Chieh Sung to the contrary inform us that penicillin exerts a bactericidal effect on this organism at a level of 3 Oxford units per cc. of urine. Streptococcus faecalis was identified in two of our cases; postoperative cultures made after introduction of penicillin therapy no longer revealed its presence.

The same researchers doubt the therapeutic value of penicillin in combating Escherichia coli, since it has been shown that this rod is capable of producing an enzyme which destroys the *in vitro* bacteriostatic activity of penicillin.[1] Steiner, in a recent report on the sensitivity of Gram-negative bacilli to *in vitro* penicillin activity, studied six strains of Escherichia coli: one was completely resistant; the other five displayed varying degrees of susceptibility, actually requiring less penicillin for complete inhibition of growth than did Staphylococcus aureus. The result of penicillin therapy in his case, in which Escherichia coli was isolated from free pus in the abdomen due to a ruptured gangrenous appendix, is similar to ours

in Case VII. Escherichia coli was the only organism recovered on routine culture in this debilitated sixty-year-old prostatic who presented advanced urinary infection, bladder stones, left hydronephrosis, back pressure on the right kidney, anemia and azotemia. Indwelling catheterization, blood transfusions and penicillin therapy improved the grave condition of this patient so that prostatectomy could be safely carried out. Escherichia coli was not identified on culture of the wound, and healing occurred per primam. Although culture before operation revealed only Escherichia coli, we believe that other organisms, most likely anaerobic, must have been present which were not isolated by routine methods, and therefore that the action of penicillin in this case was both therapeutic and prophylactic. In our other cases in which Escherichia coli were demonstrated in mixed infections, the action of penicillin was manifestly bacteriostatic, as dissemination of infection failed to take place and the few colonies persisting after operation gradually disappeared.

Recently also, total destruction of the *in vitro* bactericidal properties of penicillin by refractory strains of staphylococci has been reported, and similar studies are being made on non-staphylococcal organisms.[10] We have considered it sound practice to apply penicillin therapy on the basis of clinical improvement instead of withholding adequate treatment during the time required for bacterial study of the sensitivity of isolated organisms. When more is known of the antigenic action of Staphylococcus and other penicillinase, its addition to routine media may result in obtaining successful cultures while penicillin therapy is being carried out.

The satisfactory outcome in our seven cases of hypertrophy of the prostate is enlightening from several points of view. In addition to presenting complete retention, advanced urinary infection and azotemia, three of these patients, two of whom were senile, had coronary disease and were poor risks, indeed. As complications arose after prostatectomy, penicillin was administered therapeutically. The most remarkable feature in Case I, in which the patient was eighty-four years of age, was the rapid disappearance of marked psychosis which developed after removal of a huge adenoma. Patients belonging to this age group are especially prone to such manifestations following prostatectomy. The etiology is not always clear, and the unfavorable outlook has been a bane to urologic surgeons.[5] Proof of the toxic origin in our case appears to lie in the fact that psychic symptoms had entirely disappeared twenty-four hours after introduction of penicillin therapy. Extensive mixed urinary infection, pneumonia and suppurative orchiepididymitis followed operation in Case II. Response to penicillin therapy of all organisms except Gram-negative bacilli was dramatic; only the latter were recovered from the abscess. In Case IV, massive postoperative mixed urinary infection, including Streptococcus faecalis and Escherichia coli, which developed in spite of a long term of preliminary drainage and sulfatherapy, subsided after penicillin therapy was introduced. The therapeutic merit of penicillin in swiftly excluding the susceptible organisms which dominated the advanced mixed infection in these poor risk cases is indisputable.

In the five remaining surgical cases penicillin therapy was started from two to seven days before operation. We find it extremely significant that when penicillin was administered prior to resection of the obstructing hypertrophic prostate associated with pronounced mixed urinary infection, the only pathogens yielded by culture on the day of operation were Gram-negative bacilli. Certainly, destruction before operation of all other offending organisms contributed greatly to the smooth convalescence and rapid return to health experienced by these elderly prostatics. We are convinced that in Case VI the entrance of infected urine into the abdominal cavity through a peritoneal tear that occurred during suprapubic

prostatectomy, was averted by immediate systemic administration of penicillin. Case VIII, on whom nephrectomy was performed for multiple cortical abscesses of the kidney and drainage established for perinephritic abscess, would not have fared so well without adjuvant penicillin therapy. Staphylococcus aureus and Escherichia coli were recovered from the culture material. Penicillin therapy, started two days preoperatively, succeeded in preventing dissemination of infection. Striking was the return to normal of temperature on the second postoperative day. Doubtless, the synergistic action of systemic penicillin and local sulfonamide therapy[14] served to hasten per primam healing of the wound.

Tubercle bacilli are insusceptible to penicillin therapy; however, associated secondary pyogens may be made to disappear rapidly and often permanently under such a régime, especially if it is used in conjunction with systematic ureteral dilatation. This combined treatment not only relieved our patient in Case IX of recurrent disabling attacks of secondary infection involving a remaining tuberculous kidney, but in our opinion also prolonged his life. In Case X, chronic bilateral pyelonephritis presenting numerous acute exacerbations existed in poorly draining hydronephrotic kidneys. Organisms recovered were Escherichia coli, Gram-positive diplococci and short-chain streptococci. The picture was rendered still more serious by concomitant vesical neoplasm and cystitis. Other forms of chemotherapy, including sulfonamides and mandelic acid had been utilized; the therapeutic effect of penicillin was far superior to any. When surgical intervention becomes necessary in order to deal with encapsulated infection of the right kidney, which is suspected in this case, we plan to use systemic penicillin therapy as a prophylactic measure to avoid dissemination of infection and local application to favor wound healing. Penicillin therapy in Case XI resulted in disappearance of encrusted cystitis due to Escherichia coli and Staphylococcus aureus. The well being of the patient was so improved that he refused operation for diverticulum of the bladder.

Administration and Mode of Action. Normally, penicillin is excreted rapidly and in high concentration in the urine. For this reason various means of prolonging its action have been utilized. Diodrast, para-aminohippuric acid, epinephrine and, experimentally, human plasma have been added to the solution; the material has been suspended in beeswax and in peanut oil; and local vasoconstriction has been produced by prolonged chilling of the site of injection, in an effort to reduce the rate of absorption and excretion. Rammelkamp and Keefer showed that in diseased kidneys excretion of penicillin is much slower and plasma concentration is maintained over a longer period than in healthy organs. Defective renal function was present in all our cases, making it unnecessary to use colloid penicillin. Retention of large amounts of the agent maintained constant contact of the mold with infected tissues until body defenses were able to cope with the infection,[4] and doubtless played an important rôle in the striking response obtained in these seriously ill patients.

The continuous intramuscular[6] and intravenous[2] infusion technics are advocated by those who seek to maintain a more constant therapeutic level in the blood with a minimum quantity of the agent To date, oral administration of penicillin requires two and one-quarter times as great a dose as intramuscular injection.[8] We prefer the intermittent intramuscular method, which has been well tolerated by all our patients. We have used the sodium salt of penicillin, and our experience with it has been entirely satisfactory. As yet, no standard dosage has been established, and the amount given depends upon the individual case. In acute coccal infections such as pyelonephritis, cystitis, suppurative perinephritis, etc., 300,000 to 500,000 units of penicillin usually suffice. In chronic mixed infections, such as prostatitis

and back pressure over a period of years, and in infection developing after intervention, it has been our experience that two to three million units are required in order to obtain relief. In cases of chronic pyelonephritis recurrence is liable to take place. However, a single course of therapy is usually sufficient to control the attack, although it may become necessary to subject the patient to similar courses later. Each of our patients received 20,000 units at four-hour intervals; the minimum total amount administered was 1,000,000 and the maximum 3,000,000 units. Penicillin fastness was not encountered by us; it is well, however, to give a large initial dose, —especially when the offending organism is a Staphylococcus. No untoward reactions were observed. One outstanding advantage of penicillin over sulfatherapy is that it produces no ill effects on the kidney, such as mechanical blockage of the tubules by concretions and toxic nephrosis.

Prophylactic Use. Two types of patients presenting themselves for operation on the genitourinary organs are encountered: one in which slight or no infection exists, the other in which advanced mixed infection is present. In spite of rigid asepsis and antisepsis, infection is occasionally responsible for an unfavorable outcome. An instance comes to mind in which the superior infected pole of a kidney containing stones was resected. Subsequent overwhelming infection of the remainder of the kidney demanded nephrectomy. Had it been possible at that time to employ penicillin prophylactically, the kidney might have been spared. In the aged debilitated prostatic who is prone to infection and in whose case sulfonamides can rarely be utilized because they are so poorly tolerated, the preoperative use of penicillin will often prevent infection and start a poor risk case on a rapid return to health. It should be administered before intervention for the relief of renal cortical abscesses and perinephritic abscess. Usually, coccal organisms predominate in such cases; these are penicillin susceptible. In all subjects presenting mixed infection, it is valuable in excluding sensitive bacterial strains, thus preventing dissemination of infection. In some cases, in which only Gram-negative bacilli are recovered before operation, offending cocci are overlooked because of inadequate culture methods. In them, as in our Case VII, prompt administration of penicillin is judicious, as it may exert a therapeutic as well as a prophylactic action.

Therapeutic Use. Penicillin is the ideal chemotherapeutic agent for the aged prostatic in whom infection has developed after operation. It may prove a life-saving measure in the presence of mixed infection following any intervention on the genitourinary organs. Dramatic response has been reported when penicillin therapy was instituted after spillage of the contents of an infected renal cyst;[3] however, prophylactic administration in this type of case would be particularly advantageous. In dealing with chronic infection of the urinary tract, one should not rely on chemotherapy alone; it does not supplant operation for drainage or removal of encapsulated infection. When the kidney is infected, the importance of establishing proper drainage cannot be overstressed, and is a basic principle to which every conscientious urologist should adhere. Urethral strictures and obstructions at the bladder neck should be relieved by dilatation or operative intervention. The poorly draining, ptotic kidney should be supported by an adequate belt or permanently fixed by nephropexy,[11] obstructing kidney and ureteral stones should be removed, etc. Of extreme importance is the establishment of adequate kidney drainage by regular progressive dilatation of strictures of the ureter. Ureteral stricture and ptotic kidney are conditions which are more common than one is led to believe. Ureteral dilatation is particularly indicated in patients nephrectomized for tuberculosis, in whom stricture of the intramural portion of the remaining ureter is usually present,

favoring back pressure, secondary infection and even tuberculosis.

Local Use. The wider use of penicillin in operative wounds offers great promise. For the past five years it has been our custom to carry out thorough lavage of all genitourinary wounds with physiologic salt solution, followed by introduction of 2 to 4 Gm. of sulfonamide crystals. There is no question that a less number of wounds in our kidney and prostatic patients broke down following this prophylactic measure.[12] Now that a greater quantity of penicillin is available, so that it is no longer necessary to reserve it for grave cases only, we propose to employ this more efficient material in place of sulfonamide crystals. Infection of most surgical wounds is due to an offending coccus; therefore, combined local and systemic therapy may be expected to elicit rapid healing.

SUMMARY

Penicillin is a powerful antibiotic which is of great value as an adjunct to surgical intervention on the genitourinary organs. It does not supplant operation for drainage or removal of encapsulated infection.

Penicillin sensitive organisms present in infections of the genitourinary organs and surgical wounds are Gram-positive and Gram-negative cocci and diplococci, Gram-positive bacilli and certain strains of Gram-negative bacilli. Inadequate present day culture methods frequently fail to reveal offending anaerobes. Mixed infections are benefited by rapid destruction of susceptible organisms.

Prophylactic use of penicillin materially aids in the prevention and control of infection. In cases of perinephritic abscess, kidney cortical abscess and infected renal cyst, it prevents dissemination of infection. In the aged prostatic, who does not tolerate sulfatherapy, it is an ideal antibacterial agent.

Therapeutic use of penicillin readily controls acute infection; 300,000 to 500,000 units usually suffice. In chronic mixed infections response is slower, and two to three million units are usually necessary to afford relief.

Systemic administration of penicillin combined with local application in wounds favors prompt healing and smooth convalescence.

Eleven cases* are reported in which penicillin was used as an adjunct to genitourinary surgery. Eight were poor surgical risks and presented overwhelming mixed urinary infection. Penicillin therapy, in-

* Since submitting this article we have been able to use penicillin copiously and to observe its beneficial effects in an increasingly great number of cases. In addition to those reported in my communication, I have now employed it in conjunction with genitourinary surgery in ninety-five cases.

	Southern Pacific Hospital	St. Mary's Hospital
Suprapubic prostatectomy (including vasectomy)	12	9
Transurethral resection (including vasectomy)	1	11
Nephrectomy	2	7
Nephroureterectomy		2
Ureterectomy		1
Nephropexy	2	17
Nephrolithotomy and partial resection of kidney	1	
Orchiectomy	4	3
Orchidopexy		2
Exploration of kidney and ureter		1
Regional resection of bladder for carcinoma	1	
Cystolithotomy	2	
Nephrolithotomy		3
Repair of hydrocele	2	3
Repair of spermatocele and varicocele		2
Incision and drainage of kidney wound	1	
Nephrolysis, ureterolysis, renal sympathectomy, resection of aberrant vessel		2
Renal sympathectomy		1
Ureterolithotomy	1	
Ventral hernioplasty (postoperative bladder operation)		1
Excision of penis		1
	29	66
Total	95	

All patients received 20,000 units of penicillin intramuscularly at four-hour intervals until a total of one to five million units had been given, and the wound was lavaged with 25 per cent penicillin in isotonic saline solution. In all, the urine cleared rapidly and convalescence was shortened. We observed prompt wound healing in all but one patient, which manifested a reaction to catgut.

stituted prophylactically in six and therapeutically in five, controlled infection and hastened return to health in all. In this group of cases it has surpassed any other form of chemotherapeusis formerly employed.

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THE CRITICALLY BURNED PATIENT

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ALTHOUGH the literature on burns *per se* is both exhaustive and exhausting, the strategy for the individual patient has been neglected in the emphasis on the tactics necessary to attack the various phases of the injury. The earnest physician who seeks practical advice to meet an immediate demand will find himself confronted with abundant, confusing, and sometimes contradictory references in current literature, and with obsolescent technics in standard texts.

This paper presents a practical clinical outline for the overall management of the critically burned patient, using technics which have been found to be effective in both military and civil practice. No comprehensive review of the literature has been attempted, but pertinent references will be given in the discussion of the various stages of treatment.

On the basis of the excellent clinical and research work of the past few years, accelerated by the war and by experience in civilian disasters, certain immediate routines have been evolved, including relief of pain, débridement, use of plasma and other supportive fluids, sulfonamide applications, pressure dressings and immobilization. The ensuing stages, which may include shock, toxemia, sepsis, granulation, and need for coverage with free grafts, are recognized. The physiology and pathology of these stages are being studied, but many questions are still unanswered. The mechanism of death from severe burns in any stage is still undefined, although contributing factors have been established.

Many severely burned patients fail to survive the stages of shock or toxemia. Many that are carried through these stormy stages live for a month or two but continue to fail through the stage of sepsis, with its infected granulations and accompanying serious anemia, seepage of tissue fluids, and parenchymatous damage. Regardless of theoretical considerations, the physician is confronted with the necessity for management of the critical case, the patient who lives on from hour to hour, from day to day.

Much has been accomplished in reducing immediate mortality from burns. Perhaps the most important field for reducing the casualty list still further lies in foreseeing and circumventing the various critical sequelae to the immediate trauma. The fluctuations in the course of such cases must not merely be met; they must be anticipated. Every therapeutic aid must be employed to reinforce the struggle of the bodily mechanisms against toxemia and infection; no less important is the avoidance of any agent which might impair those mechanisms.

Maintenance of the patient's bodily equilibria is the primary need. All necessary physical measures should be carried out rapidly and gently, to prevent further trauma and to facilitate concentration of attention on supportive therapy. The patient does not die from the burn trauma itself; he dies either as a result of intractable circulatory imbalance and its sequelae, or as a consequence of inappropriate treatment, local and systemic.

We must make certain that the tactics on one salient contribute to the overall strategy and do not conflict with tactics directed toward another salient.

DIAGNOSIS OF "CRITICAL STATE"

Treatment should be instituted before critical symptoms and signs appear, not afterward. This means that if there is any

doubt as to the exact degree of severity the patient should be considered to be critically burned. Age and general condition are, of course, also important factors. A patient whose burns are truly critical may show only an extensive hyperemia and small areas of charred skin on first inspection, so that it is not possible to determine the degree of the burn immediately. Furthermore, as will be discussed later, the degree of the burn may be severe more as a result of improper treatment than of initial trauma.

If 25 per cent or more of the body area is involved and the patient shows signs of previous, present, or impending shock, the "critical" treatment should be instituted at once regardless of any apparent superficiality of the burn.

Cyanosis, unconsciousness, rapid and feeble pulse, are among the well known signs of shock. In burns an important sign may be the condition of the tongue. If it is dark brown and edematous, with an almost charred appearance, it is an infallible indication that the patient is in critical condition. This sign may appear at any time during the first week.

It has been pointed out that in burn cases shock may be present without notable signs.[1] This observation emphasizes the importance of adequate treatment. It is far better to find that more than adequate care has been given to a moderate burn than it is to be confronted with a terminal emergency arising from inadequate treatment of a critical burn.

CONTROL OF PAIN

Relief of pain is of course the initial consideration in any régime. Morphine is used as necessary to achieve it. Up to ¾ gr., given in ¼ gr. doses, may be necessary in the first hour.

However, it should be remembered that the more rapidly and gently the initial débridement and dressing are carried out, the less need will there be for morphine. A satisfactory medicated pressure dressing is in itself a major anodyne.

It has been pointed out that restlessness and delirium may be mistaken for pain, and that excessive administration of morphine may precipitate shock and terminal crisis; and it was suggested that barbiturates might be utilized to lessen the amount of morphine required. Overuse of the barbiturates, however, might in itself be dangerous, whether in the shock period with its constant threat of anuria or in the later stages; the extensive parenchymatous damage in the toxemic stage would interfere with hepatic destruction or renal excretion of the barbiturate, and would magnify the possibility of toxic accumulation in the system. After the initial period codeine sulfate (½ gr.) is given hypodermically three times a day and is usually sufficient to control pain.

DÉBRIDEMENT

Débridement should be minimal, and all initial procedures should be carried out rapidly. Opening of blisters, painstaking removal of dead tissue, and vigorous cleansing are contraindicated. A critically burned patient may be past the initial shock upon arrival at the hospital, but the time spent in moving him about, plus the additional trauma of thorough débridement, may throw him into secondary shock. Furthermore, excessive débridement and too frequent change of dressings have been responsible for the conversion of many a second degree burn into one of the third degree. Supportive measures to ward off shock and build up the patient's reserve are the urgent considerations, rather than surgical perfection in débridement. In the average practice, too much time has been given to the burned areas, and too little consideration paid to circulatory imbalance.

The areas should be cleansed lightly and rapidly with white soap and water, rinsed with physiological saline solution, and dried. In some instances, as in industrial accident cases, it may be necessary to use an appropriate detergent to remove

large quantities of grease or other foreign substance in the burned areas.

Even if there has been no contamination with soil, tetanus antitoxin should be given, in the usual prophylactic dosage of 1,500 units, after a preliminary test for sensitivity.

INITIAL DRESSING

The initial dressing should control infection, supply pressure to check capillary dilatation and fluid loss, and prevent inspection and handling. The last item may be the most important. The value of pressure dressings has been firmly established. Various forms of such dressing, and the use of gels, plastics, serum, ointments and other adjuncts, have been advocated, each advocate offering convincing reasons for the superiority of his own particular technic. Such success may frequently be ascribed to the fact that all these methods serve to keep the physician from exposing and handling the injury while it is healing.

In the practice of controlled exfoliation for correction of surface defects of the skin[2] it has been noted that a first degree burn will heal in four to five days if there is no interference; if it is dressed or inspected too frequently it may resolve into a second degree burn. Similarly, a second degree burn will ordinarily heal in from ten to fourteen days, but may be converted to a third degree burn with frequent inspection and change of dressings. It is only in the later stage of granulation of third degree wounds that dressings require frequent change to facilitate the reparative process.

The use of tannic acid and similar surface films on burned areas is fortunately becoming obsolete.[3] The coagulum films serve to protect the area from interference, but invite serious problems when necrotic tissue is present and septic areas are encased. If the film is not water-soluble, its removal is difficult and traumatizing. If it is water-soluble, it does not prevent the escape of tissue fluid. Furthermore, coagulating agents may produce serious systemic effects; tannic acid has been demonstrated to have a deleterious effect on the hepatic cells.

The use of plaster dressings is praiseworthy from the standpoint of protection and immobilization, but also has the drawback of being difficult to remove. In addition, the odor from such dressings may be offensive and offers an institutional as well as an individual problem.

The simple pressure dressing, using gauze, cotton waste material, and roller bandage, is therefore the method of choice. A moist pack is used because it molds itself to the part covered, and dries to a firm even cast which will not slip. The usual dry pack has a tendency to slide out of place even with the most careful transfixion with bandage and adhesive. The use of the moist pack offers advantages claimed for plaster dressings while retaining those of the usual pressure dressing.

A word of caution against overenthusiastic use of the roller bandage is in order. This is particularly true in burns of the extremities where too zealous application of pressure may result in what might more appropriately be called strangulation. With a moist pack to obviate slipping there should be no temptation to use excessive pressure.

The question of what agent should be used topically before bandaging has been another source of controversy. Simple grease applications for lubrication and protection have the soundest physiological basis. In controlled exfoliation, for example, where no contamination is present, the use of bacteriostatic agents would be redundant. But in most traumatic burns contamination must be reckoned with and local use of sulfonamides is necessary to reduce the possibility of spread of infection. Systemic use of sulfonamide is not recommended at any time in the course of a severe burn. To the difficulty of maintaining and checking therapeutic blood levels may be added the possibility of severe reaction and the dangers of inade-

quate excretion in a patient with widespread parenchymatous damage and renal insufficiency.

The objective, then, is to find a proper vehicle for the sulfonamide—one which, combining water and oil phases, will release the drug in optimal amounts from the dressing to the burned surface. The following preparation is our choice for the purpose:

Petrolatum	500 cc.
Sorbitol mono-oleate (oil soluble)	20 cc.
Sorbitol mono-oleate (water soluble)	3 cc.
Sulfathiazole powder	50 Gm.
Distilled water	500 cc.

The petrolatum and the sorbitols are mixed and heat sterilized. The sulfathiazole is sterilized and dissolved in the sterile distilled water. The solution is then emulsified with the petrolatum mixture, with aseptic precautions throughout the process.

A quantity of 3 by 12 inch strips of fine mesh gauze are placed in a sterile porcelain dressing tray. On top of these strips is placed a quantity of the prepared ointment. The tray is then covered and heat treated, below 210°F., just long enough for thorough permeation of the ointment into the gauze. Overheating tends to cause separation of the oil and water phases.

The formula given above is essentially that of Jenkins et al. (the proportion of the water soluble sorbitol is slightly larger), who have published an excellent discussion of the problem of suitable sulfonamide vehicles.[4] The use of the prepared gauze strips, already impregnated with ointment, was devised to make possible a more uniform dressing and to facilitate its application.

The usual water-soluble sulfathiazole ointments are not recommended, since they dry out quickly and cause the dressings to adhere to the burned areas.

The actual dressing is applied as follows: The sterile impregnated strips are applied over the burned areas. Over the strips are applied 4 by 4 inch gauze sponges which have been dipped in physiological saline solution and then expressed. Over these are placed sterile A pads or cotton lint waste. The dressing is held in place with heavy roller gauze bandage and sufficient adhesive tape to assure transfixion. The roller bandage should be applied with reasonable firmness to insure steady even pressure, but should not be drawn too tightly. The use of elastic roller bandage is to be condemned, since the tension it supplies is too great. If the chest or trunk is involved a binder is used for the outer covering.

Once applied, the dressing is left undisturbed for ten to fourteen days, and all measures are directed toward systemic support rather than local care. Frequent re-dressing introduces infection, causes pain, checks normal proliferation of new epidermis or of granulation tissue, and destroys such new tissues as attempt to form despite the excessive handling.

After débridement and dressing, the patient is placed in bed in a slightly elevated position, the limbs also being slightly elevated. The use of the cradle has no place in modern therapy.

Patients are more comfortable with a covering of bed sheets, without blankets. While actual chilling is to be avoided, it is now recognized that heat has no place in the management of shock, frank or incipient. We are dealing with a problem of excessive capillary dilatation, and our efforts are directed toward controlling and reducing it rather than increasing it by such means as heat.

PERIOD OF SHOCK

For the first two to three days the danger of shock is ever present. All therapy is directed toward warding off circulatory failure. In the early stages the parenchymatous organs do not undergo damage as a result of toxemia but rather from the generalized edema and capillary hemorrhages. If the edema is extensive in the brain or lungs early fatality results.

Plasma transfusions should be started at once, and the dosage should be massive. Ten to 20 units (3,000 to 6,000 cc.) should

be given during the first forty-eight hours, the bulk of it during the first twelve hours. This should be supplemented with intravenous or hypodermoclysis of isotonic electrolyte solutions (sodium chloride and sodium bicarbonate), some containing glucose (to furnish 400 Gm. for the first forty-eight hours). Such electrolyte solutions should be used in amounts roughly equal in volume to the amount of plasma used. If the patient is able to take some fluids by mouth, some of the electrolyte solution may be given in this fashion. However, in this paper we are dealing only with the critical case; and the patient in critical condition is ordinarily unable to take and to retain fluids given by mouth during the shock period. Our chief route of fluid administration must be parenteral; and our chief source of fluid must be plasma.

In these cases the reduction in circulating blood volume is so great, and the areas for permanent loss of protein through seepage so large, that only massive substitution therapy can meet the demand. The electrolyte solutions are also needed to replace salt loss and to combat dehydration, anuria, and parenchymatous damage. The suggested dosages of fluid seemed radical at the time the author first found them successful in combating shock in critical cases. It is interesting to note that a recent publication by Harkins et al.[1] under the auspices of the Subcommittee on Shock, outlines a routine of fluid administration which for critical cases would entail even larger volumes. This report is commended to the reader as an excellent summary of modern fluid therapy, with details of preparations of suitable isotonic solutions and formulae for determining the necessary volumes of plasma.

For the first seventy-two hours a close check of the urine is important. The patient is catheterized each eight hours as a routine measure. This is more effective and less trying to the patient than continual efforts to void. A satisfactory urinary output, of course, lessens the necessity for parenteral electrolyte solutions.

Oxygen is an important adjunct in supportive therapy. While there have been many arguments pro and con its value,[5] clinical results have seemed to warrant its routine use in these critical cases. The margin of safety is so narrow that any increment may prove to be life-saving. The critically burned patient is placed in an oxygen tent for the first forty-eight hours, with occasional short rest periods to avoid possible respiratory irritation. The tent rather than the catheter or face mask is used because it is more comfortable for the patient and facilitates nursing care.

Cardiac, respiratory, and circulatory stimulants are numerous and each has its proponents and opponents. No discussion of this subject will be attempted, for such drugs play only a minor rôle at best. Adequate return of blood to the heart and replacement of lost or displaced plasma proteins are the necessities of the body, and if these are provided artificial stimulants will ordinarily be unnecessary.

PERIODS OF TOXEMIA, SEPSIS, AND GRANULATION

With minimal trauma in dressing the wounds, with every precaution to husband the patient's strength and make him as comfortable as possible, and with adequate fluid therapy, the shock period may be safely passed. But vigilance cannot be relaxed during the ensuing weeks.

The period of toxemia follows the period of shock, and is usually over by the time the initial dressing is to be changed. The period of granulation follows until repair is complete. A period of sepsis may be superimposed at any time following the shock period but is usually encountered following the toxemic stage. Sepsis is as a rule the result of improper care or of a delay of many hours between the inception of the burn and the arrival of the patient for treatment.

Plasma ceases to be an important therapeutic agent once the patient has entered the toxemic period. The emphasis now is directed to use of whole blood and a deli-

cate control of electrolyte output and intake.

The initial hemoconcentration is usually gone; but it must be emphasized that not only is the relative number of red cells reduced but also those cells which are circulating are not functionally normal. There has been much discussion of tissue toxins in these stages. It is sometimes forgotten that blood, too, is a tissue, and that the red cell's capacity as an oxygen carrier is quite as susceptible to obscure derangements as is the filtering capacity of a glomerular cell. Whole blood, therefore, is needed in order that the body receive an adequate supply of oxygen. It is required whether the anemia is frank or is masked by dehydration or malfunction of cells present in normal concentrations. Blood is thus given in the toxemic stage chiefly as an oxygen carrier. In the later stages of granulation it is needed to correct hypoproteinemia and secondary anemia.

If at the end of the third day the clinical condition of the patient is not satisfactory, it is advisable to give 500 cc. of whole blood even if the red count is 6 or 7 million. The results are frequently dramatic. It may be pointed out that with such high counts as these, the whole blood transfusion does not actually increase the count but serves rather as a dilution. The important factor, however, is that healthy red cells capable of function be present.

In a frank anemia, larger amounts of whole blood will be necessary, and they must frequently be administered over a period of several days in order to bring the red count up to at least a low normal level. The red count should be carefully watched throughout the course, and whole blood should be used without hesitation whenever anemia threatens. Three to five transfusions of 500 cc. each are usually required each week during the first two weeks, but it may be necessary to give a transfusion daily. Washed red cells may be given as an adjunct in amounts up to 300 to 500 cc. each week. Rh typing should be a routine, since these patients must not be exposed to any possibility of a transfusion reaction.

Throughout the stages of toxemia and granulation the estimation of the necessary requirements for electrolytes and water is a difficult problem, but one which must be solved. During the early toxemic period the massive tissue edema resulting from the initial shock is being resorbed, but fluid, protein, and salts are seeping from the burned areas. Vomiting may cause fluid and electrolyte loss. As the patient progresses into the stage of granulation, nutritional difficulties and protein loss from the areas may again lead to edema. There must be a continual balancing of these factors of protein, fluid, and electrolytes to avoid both the Scylla of edema and the Charybdis of dehydration. The reader is again referred to the article of Harkins et al. for valuable material on these phases.

When large quantities of whole blood are given it is possible to reduce the amount of salt administered, although glucose and water will still be required. When less blood is needed, electrolyte administration must be increased. So far as possible fluids should be given by mouth; but if adequate intake cannot be maintained, glucose in saline solution must be administered parenterally.

Beginning edema may be signalized by perspiration of the unaffected areas of the skin and by urinary incontinence. If these signs appear the fluid intake should be cut 50 per cent during the following twenty-four hours. Or if any seepage is observed from a site of injection, the fluid intake should be sharply reduced at once.

Dehydration is usually marked by a sudden sharp rise in temperature from base levels, for example, a rise to 104°F. from a consistent 101°F.

The urinary output should be closely checked and listed against the fluid intake. The condition of bed linen and dressings should also be noted and recorded as a check of fluid loss. If the urinary volume drops below 400 cc. in twenty-four hours, a hypodermoclysis of 1000 cc. of isotonic

saline should be given, constant watch being maintained for signs of edema.

Abdominal distention is a common complication in the third or fourth week and even if the percussion note is tympanic it is advisable to catheterize such patients occasionally.

Prevention of edema cannot be accomplished unless adequate protein levels are maintained. Such maintenance is difficult because of the loss of and increased need for nitrogen. Loss of protein from burned surfaces, in the urine, and from toxic alterations of tissue proteins, the increased need for protein for regenerating tissue and red cell proliferation, and the patient's inability to ingest adequate nourishment are all factors in producing the typical hypoproteinemia and negative nitrogen balance.

Plasma is sometimes used as a protein-providing substance, but its relatively small protein content makes it an expensive source. If it is given late in the course, there may be a protein reaction, evidenced usually by minor chills followed by elevation of temperature of two or three degrees for twenty-four hours. When plasma is used two units should be given, for if a reaction appears it will be no more severe with two units than with one.

In critically ill patients in the third to fourth week, with sepsis superimposed on the granulation stage, it is impossible to furnish adequate nourishment parenterally and the patient usually refuses food by mouth. In such cases the nasal catheter must be used for duodenal feeding. It is left in place for forty-eight hours before removal for cleansing.

Protein may be given in such forms as meat extracts, milk, or amino acids. The latter are theoretically ideal, but in practice are difficult to ingest and to retain. Adequate intake of iron and of vitamins, particularly vitamin C, should be maintained.

Because of the parenchymatous damage, and the tendency to anuria and uremia, the use of sulfonamides by mouth is not recommended. As a prophylactic to forestall pulmonary infection and to prevent the spread of sepsis, penicillin is the agent of choice. After the first two weeks, if a septic type of temperature appears or if culture shows a mixed infection of a type accessible to penicillin, 200,000 units are given, divided for administration every three hours, over a twenty-four-hour period.

It is unfortunate that penicillin is not suitable for local therapy in septic cases. Too much is lost in the dressings for it to be effective, and it is also quite irritating and painful when applied to the injured areas.

INSPECTION, DÉBRIDEMENT, AND CARE OF BURNED AREAS AFTER REMOVAL OF INITIAL DRESSING

The initial dressings are left intact for ten to fourteen days. There is no rational excuse for inspection during this period. The burned areas are in almost all cases contaminated from the onset, and the surface bacterial count will not be lowered by daily change of dressings in the early stages. Indeed, with the usual hospital technics—use of the general dressings' cart and so on—it will be raised. The necrotic tissue itself probably contributes little "toxic" material to the circulation, certainly not enough to cause a fatality.

Removal of dressings, and all subsequent inspection and re-dressing of the areas, must be carried out under aseptic conditions. While the initial débridement is usually done with proper aseptic technics in the surgery, the ordinary routine for care leaves open many paths of infection. Dressings for burn cases should be made up in individual packages, each containing sufficient material for a dressing, and appropriate instruments.[6] These packages should be sterilized, marked with the patient's name, and be at hand for each inspection, being ordered in advance on the hospital chart. The physician should be properly gowned and masked and the patient draped as for any aseptic procedure. With such precautions the incidence

and severity of septic infections can be greatly reduced.

When the outer layers of the dressing have been removed, the layer next to the wound may be found to be adherent. In such a case it should not be lifted off at once. Instead, a liberal amount of hydrogen peroxide should be poured over the area. In a few moments it will be found that the dressing has loosened and may be gently removed. If a few spots are still adherent, the free dressing is deflected gently from the burned area and addition hydrogen peroxide is poured directly on the junction between the wound and the dressing. This procedure prevents any damage to the denuded areas or to tender new tissues.

The degree of the burn may now be determined. The first degree burn will show hyperemia with complete epithelization. The second degree burn will show the exposed corium with many hair follicles, the appearance being similar to that of the donor site following the removal of a thin sheet of skin for grafting. There will be areas of complete epitheliazation. The third degree burn shows dull white patches, leathery dark brown coagulum, or healthy cherry red granulation surface.

Complete débridement is now carried out. Blisters are opened and loose necrotic tissue is excised. If the area shows no healthy granulation tissue, grease dressings exactly similar to the initial dressing are applied. They are changed every three days, with débridement, until granulation tissue appears. If granulation tissue is present, wet dressings are begun in order to encourage the reparative process. Fine mesh gauze wet with distilled water is used to cover the areas, which are then padded with wet gauze and encased in roller bandage. The dressings may be kept moist by means of Carrel tubes included within them, or may be soaked three or four times a day and kept covered with cellophane or rubber. Sterile water is used for the soakings; in these large areas there is danger of absorption or irritation from solutions of boric acid, magnesium sulfate, salt solutions, and similar substances.

SKIN GRAFTING—USE OF HOMOGRAFTS—NEW TYPE OF STRIP GRAFT

The ideal coverage for a granulating burn surface is conceded to be the autograft. However, these critically burned patients present a difficult problem. In some cases the additional insult produced by the anesthesia and trauma necessary for even minimal autografting would be sufficient to produce fatal results. The poor nutritional state reduces the likelihood for a good "take," yet continuous seepage from large areas defeats all attempts to maintain the nitrogen balance.[7]

In such extremely debilitated patients the use of homografts may be life-saving. Large sheets of skin (thin split grafts) may be removed from donors and placed, without peripheral suturing and without anesthesia, on the burned areas. The usual dry pressure dressings, of gauze sponges or cotton lint waste, are applied. The plasma-heparin agglutination technic may be used if preferred to seal the graft to the area, and the pressure dressing then applied. After five days, the initial dressing is removed and the areas re-dressed. Inspection is carried out every two days thereafter, with change of dressings. Frequent change is necessary in these cases because there is considerable soilage.

Once placed, these homografts furnish immediate and excellent occlusion of the surface; there they will slowly liquefy. It may in some cases be necessary to repeat the process two or three times; but each time the granulation surface will appear cleaner, and healing by scar formation will ensue. The period of homograft coverage may extend from four to six weeks when two or three grafts are applied in succession. If the patient's condition permits, autografting may be done at the end of this time; if not, scar formation is permitted to proceed. Six months or a year later, if the scar is

deforming or produces a vocational handicap, it may be excised and secondary repair may be carried out with autografts.

reckoned with and corrected. Adequate tension and suturing are essential for adequate utilization and "take."

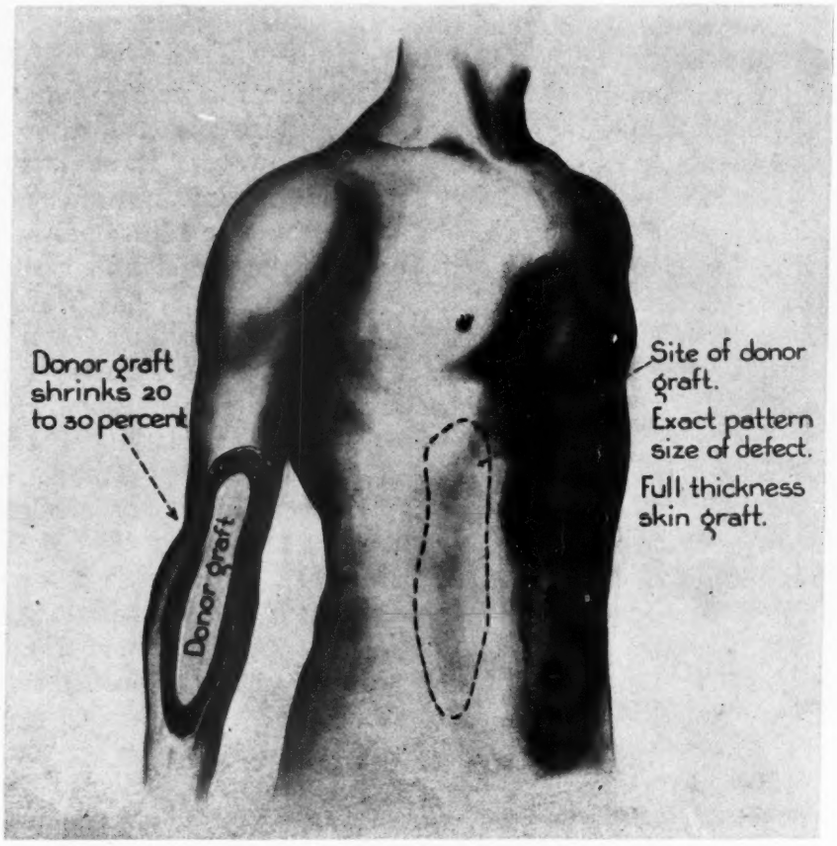
Donor graft shrinks 20 to 30 percent
Donor graft
Site of donor graft.
Exact pattern size of defect.
Full thickness skin graft.

FIG. 1. Contraction of normal skin on removal from donor site.

In removing such homografts from donors, it must be remembered that normal skin will shrink to 60 to 70 per cent of its original size upon removal. Since the donor graft is not peripherally sutured to the site, it is necessary to compensate for this shrinkage by a corresponding increase in the size of the graft. (Fig. 1.)

When the condition of the patient warrants autografting, but the amount of skin available is insufficient for total coverage, the usual procedure is to apply pinch or stamp grafts. However, because of the natural contraction just discussed, such grafts ordinarily cover only 60 to 70 per cent of their potential. Even if a sheet of skin is large enough to furnish coverage for the greater part of the granulation tissue its full benefits are frequently lost because contracture is not

To obtain maximum utilization of the available material, a new type of strip graft has been devised. (Fig. 2.) The strips of skin are cut 1 inch wide and 4 to 8 inches long, according to the size of the raw area to be covered. The strips are sutured at each end to the periphery, under strong tension, and are placed 1 inch apart in parallel rows. Interrupted cotton sutures are placed, 1 inch apart, from strip to strip and from the terminal strips to the periphery. After these sutures are in place, traction is applied at either end by the surgeon and his assistant, and the sutures are tied off. The full normal width of the strips is thus restored, and a complete "take" is assured. Proliferation will take place from the edges of the strips to ensure maximum coverage. The use of strong tension also prevents a patch-like

appearance of the graft after healing, the donor strips taking on the characteristics of the normal skin of the area grafted.

2. During the first forty-eight hours intensive care to support the circulation and ward off shock is the primary consideration. Massive doses of plasma and adequate electrolyte intake are the chief adjuncts in the treatment of the critically burned patient.

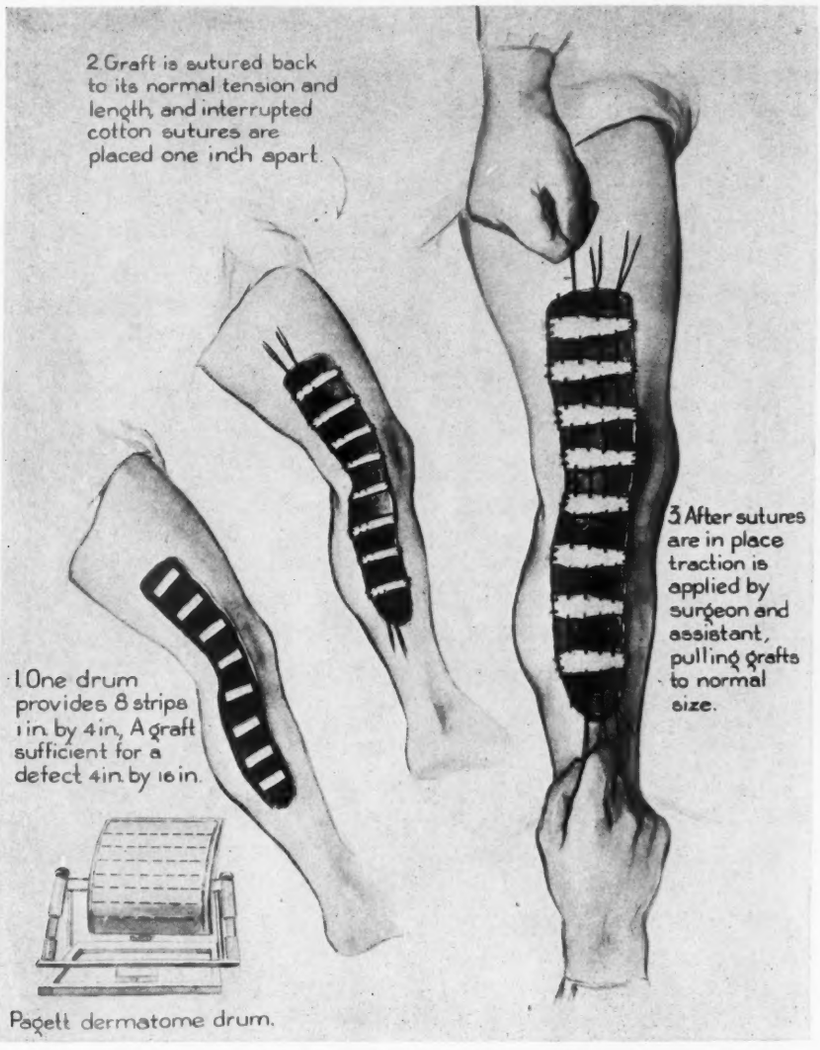
2 Graft is sutured back to its normal tension and length, and interrupted cotton sutures are placed one inch apart.
3 After sutures are in place traction is applied by surgeon and assistant, pulling grafts to normal size.
1 One drum provides 8 strips 1 in. by 4 in. A graft sufficient for a defect 4 in. by 16 in.
Padgett dermatome drum.

Fig. 2. Technic of preparing and applying strip graft for maximum coverage.

All sutures are specially prepared, previous to the operation, by being immersed in sulfathiazole solution and allowed to dry. They are then sterilized as usual.

Autografting technics, including procedures for after-care, have been given in detail in a previous paper.[8]

SUMMARY

1. Initial care of severe burns should include rapid and minimal débridement and bacteriostatic pressure dressings.

2. During the first forty-eight hours intensive care to support the circulation and ward off shock is the primary consideration. Massive doses of plasma and adequate electrolyte intake are the chief adjuncts in the treatment of the critically burned patient.

3. Once the period of acute circulatory crisis is passed, the stages of toxemia and of granulation follow, and sepsis may ensue. Adequate use of whole blood transfusions, a delicate balance between edema and dehydration (achieved by proper administration of fluids), and maintenance of nitrogen balance are necessary. Penicillin is used to combat sepsis.

4. The initial dressings must not be disturbed for at least ten days. After that time they should be changed with the aseptic precautions required for surgery.

5. Homografts may be used successfully to ensure temporary skin coverage and preserve life in the critically burned.

6. When the condition of the patient permits some autografting, a new type of strip graft insures maximum utilization of the available graft material.

CONCLUSION

The care of the patient rather than of the affected areas should be the primary concern in the treatment of the critically burned patient.

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The person in shock should be protected from cold or exposure. Blankets, guarded hot water bottles, a tent or canopy containing superheated air from electric lights or other source should be used.

From "Principles and Practice of Surgery" by W. Wayne Babcock (Lea and Febiger).

THE USE OF A BLOOD-KAOLIN-PENICILLIN PASTE IN THE TREATMENT OF VARICOSE AND TORPID LEG ULCERS

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IN the last few years several methods were published utilizing blood in the therapy of varicose ulcers. Richter advised (1941) the sprinkling of the patient's blood on gauze covering the ulcer. Moorehead and associates described (1943) a laboratory method of the production of a red blood cell concentrate salvaged from the bloodbank. Naide and Meyer (1943) placed 5 cc. of the patient's blood on his ulcer and let it dry there for one-half hour to two hours before dressing. Sheldon and Young of the Mayo Clinic advocated in 1943 the use of dried red blood cells realizing the difficulties in keeping the semiliquid material in contact with the wound. Finally, Murray and Shaar produced (1944) a blood cell paste of the following composition: 250 cc. fresh blood cells type 0 and 25 cc. of a hexylresorcinol-tragacanth mixture (75 cc. of 1:1000 hexylresorcinol solution and 2.5 Gm. powdered tragacanth).

These authors believe that necessary nutritional elements are supplied by the blood paste to the deficient tissue which has been starved by inadequate circulation. A more important factor, however, seems to be the protective action of the blood, which, after formation of a blood crust, acts as an immobilizing splint under which epithelization takes place undisturbed, imitating the normal process of wound healing.

Considering the requirement of ambulatory treatment of varicose ulcers the writer adopted a simple and time-saving method, whereby the patient's blood, or group 0 from a bloodbank, if available, was mixed with equal parts of kaolin. To this mixture ½ cc. of penicillin standard solution (5000 units per cc.) was added to 10 cc. paste. Originally, ceepryn or tyrothricin was used, but later on was abandoned. Only occasionally where penicillin resisting Gram-negative, saprophytic and paracolon bacilli prevailed ceepryn concentrate (2 drops to 10 cc. paste) was resorted to.

In the office the preparation of the paste could not be carried out under aseptic conditions. However, the addition of penicillin was considered as a safeguard against contamination. Since in all cases the area to which the blood paste was to be applied was primarily infected, it did not seem necessary to use an absolutely sterile paste. Superimposed infection after the use of the paste never occurred.

The paste was applied to the ulcer, and covered with 1 sheet of gauze. A thick layer of talcum powder was spread over the gauze, and the entire leg encased in an Unna's paste boot or an elastoplast bandage. The bandage was changed every five to eight days, and the patient kept ambulatory if possible.

After a few days the paste turned into a grayish-yellow crusty mass adhering partly to the bandage, partly to the skin, especially in areas deprived of epithelium. The crust could easily be removed by water, hydrogen-peroxide and ether. Sometimes a sharp spoon proved to be useful in removing the softened crusts.

Observations made on 19 cases resulted in following conclusions: (1) The blood-kaolin-penicillin (b-k-p) paste was well tolerated by all patients. (2) There was a definite pain-relieving effect noticeable, especially in cases of irritable ulcers. (3) While a drying effect was evident in all ulcerations, a phlogistic action was noted

on chronic eczematous regions leading to exudation and hyperemia. The b-k-p paste should be limited to the ulcerated area only, and kept away from chronic eczematous areas. In spite of the drying effect the ulcerations showed healthy red granulations with normal turgor replacing necrotic membranes after two to nine applications. The epithelium started to grow from the wound margins underneath the crust. (4) The local hemotherapy in varicose and trophic ulcers is not a panacea. Adjunct therapy, such as high and low ligation of the saphenous vein, sclerotherapy, supportive bandages, and bedrest in selected cases is indicated to assure healing.

Case Reports. There were three cases of irritable ulcers, one at the malleolus internus, one over the tibia, and one in the lower third of the leg above the externus malleolus. The ulcers were lying in dense cicatricial areas, and were extremely painful. There was a low grade infection with scant exudation. The condition persisted from three to six months. All three patients received b-k-p paste plus Unna's boots and sclerotherapy. Two patients had high ligations done. There was a striking relief of pain after the second, third and fifth application. All three ulcers were cured after the ninth and twelfth bandage.

The second series consisted of four cases of chronic eczema of the lower leg, with partly deep and partly superficial ulcerations. One patient showed a moderate degree of varicose veins. The other three patients did not exhibit visible signs of venous disorder. These three patients were extremely obese, weighing between 250 and 310 pounds. There was a severe degree of lymphostasis in both legs. The eczematous areas were in the lower half of the legs. The skin appeared thickened, brown-red, partly covered with scales, partly deprived of epithelium, showing superficial and deep ulcerations with fetid secretions.

In all four cases the application of the b-k-p paste was restricted to the ulcerations only. Since the paste had an irritating effect upon the eczematous skin leading to exudation, it had to be omitted occasionally. The patient with varicosities received sclerotherapy and three b-k-p paste applications with Unna's boots. Six more treatments with supportive bandages cured the eczema. The other three cases did not undergo surgical treatments. All ulcerations were cured with the b-k-p paste, using eight, nine and sixteen applications. Two patients of this group are still under treatment for chronic leg eczema without having blood paste applications.

In the third series there were four cases of varicose ulcers associated with arteriosclerosis of the vessels of the leg, one patient being sixty-seven years, the other sixty-eight, the third seventy-two, and the fourth sixty-five years old. One leg ulcer of a diabetic female (seventy-two years old) healed after eight applications of blood paste. One patient received eleven applications, then interrupted the treatment. After his return the small ulcerative area was undercut, and it closed up after sixteen applications of blood paste plus Unna's boots. The third patient showed a year-old ulceration of the size of a silver dollar in the middle of the lower third of the tibia. The surrounding skin presented a chronic eczema with signs of trophic disturbances. The wound had a torpid appearance without granulations. There was a large amount of fetid secretion. The patient received nine applications of blood-kaolin paste plus ceepryn (later on penicillin) plus Unna's boots. The ulcers closed entirely with a firm scar. In the fourth case the treatment with b-k-p paste had to be discontinued on account of pain and lack of coöperation. This patient showed two large torpid ulcers at the lower third of the lower leg surrounded by chronic phlebitic veins. She had suffered from varicose ulcers for twenty years and had been treated by pinchgrafts fifteen years ago.

The fourth group consisted of five cases of typical varicose ulcers ranging from the

size of half a fingernail up to a childs palm. All cases were treated uniformly with b-k-p paste and Unna's boots. They had persisted from three weeks up to eight months before treatment was instituted. In one case a three months old ulcer was cured after the first application of blood paste plus Unna's boot. In the other cases it took from six to twenty-two applications to effect a cure. Three patients of this group underwent high ligation and sclerotherapy, and two patients sclerotherapy alone.

In the fifth group was a patient who showed a torpid ulcer at the dorsum pedis. The patient, a bedridden seventy-four year old female, was suffering from excessive hypertrophic arthritis of both hands and feet, and from an intestinal malignancy. All joints were totally ankylotic; the skin of both feet and legs showed trophic disturbances. The ulcer of the foot was 1.5 inches by 2 inches in size. The area was extremely painful. The base did not show any granulations and had a dark red appearance. There was a low grade chronic infection. The patient received daily applications of blood-kaolin paste. Being at home she could not be closely supervised. After four weeks of more or less thorough treatment there was a slight improvement of the ulcer, but it never closed. A new ulcer formed on the other leg. The case could not be followed up. Therefore, the definite value of the blood paste could not be stated here. The patient finally succumbed to her malignancy.

In the last group were two cases of slough following sclerotherapy. The ulcerations which were of the size of a small pea and of a small hazelnut, respectively, closed up after eleven and fourteen semiweekly applications of blood paste.

In a few cases the blood paste was used as a vehicle to which riboflavin, viosterol, sulfonamides and tincture digitalis (K. Schlaepfer and Baron) were added. A striking effect could not be noted. The series, however, was too small to allow any definite conclusion.

SUMMARY

A blood-kaolin-penicillin-paste was used in the treatment of 19 cases of varicose and trophic leg ulcers with and without chronic eczema. In two cases the paste failed to effect a cure. A thorough and exhaustive treatment, however, could not be carried out here.

Superficial and deep ulcerations were benefited by the blood paste, whereas chronic varicose eczema became aggravated.

Stimulation of granulations, promotion of epithelization, reduction of infection and a pain-relieving effect upon irritable ulcers were evident.

The paste can be easily made, using the patient's own blood, adding kaolin ana partes and ½ cc. of penicillin (5,000 units per cc.) to 10 cc. paste.

The b-k-p paste may be considered as a valuable adjunct in the treatment of varicose ulcers. It seems to exert a nutritional and protective effect upon the ulcerations. In the therapy, however, the reduction of the venous backflow by ligation, sclerotherapy and supportive bandages must not be neglected.

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Case Reports

BILATERAL FRACTURE OF THE SCAPULA

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THE paucity of reports in the literature relative to bilateral fractures of the scapula bespeaks their rarity. A careful review of the literature from 1916 to 1944 revealed no reference to a case of this type. It is possible that reports of such injuries may have been made and were missed by the authors, but it is believed that the injury is rare enough to warrant reporting the authentic case herein described.

Unilateral fractures of the scapula are still considered uncommon even with the almost universal use of *x*-ray in the diagnosis of fractures. The position, shape and size of this bone would lead one to believe it might be a frequent site of fracture. However, compared to the adjacent bones with which it articulates, it is relatively free from injury. This could well be ascribed to the thickened edges which reinforce the plate of bone, its great mobility on the chest wall and its position between thick pads of muscle.

MECHANISM

There are in general two mechanisms by which fractures of the scapula are sustained: indirect and direct violence. The former is the most common and is virtually the only means of fracture of the glenoid and surgical neck being produced if the fracture is not compounded. A fall on the hand, elbow or shoulder, with force transmitted through the humerus while the scapula is pulled forward by the serratus magnus, is the usual means of a fracture of this part of the bone, and there may be a buckling with a fracture of the body, spine or both. However, the latter component of the bone may be broken as the result of direct violence with varying degrees of damage to the soft parts. Fractures of the coracoid and acromion are relatively uncommon except in severe compound fractures about the shoulder. The foregoing facts should be taken into consideration in the selection of the choice of treatment in complicated fractures of the scapula.

CASE REPORT

A thirty-year old negro male, entered the hospital on July 6, 1944, with a chief complaint of pain in both shoulders. He stated that about one hour previously, while driving a heavily loaded truck on a loose-gravel road, the vehicle had overturned. The patient was never rendered unconscious although he was unable to state the exact manner in which he sustained his injury. He did state that he fell on his back with his shoulder striking the ground first, and the vehicle, under which he was pinned, struck him across the chest. It was concluded that this probable direct violence transmitted into his shoulder was the mechanism of injury in this case.

Physical examination revealed a short, strong-statured individual weighing 165 pounds with all findings essentially negative except for marked tenderness of both scapular regions and with limitation of movement of the shoulder joints. Any attempt to move his arms greatly aggravated his discomfort. *X*-rays revealed comminuted fractures of both scapulae. His

left scapula showed little displacement (Fig. 1), but his right had marked displacement of the fragments with considerable comminution.

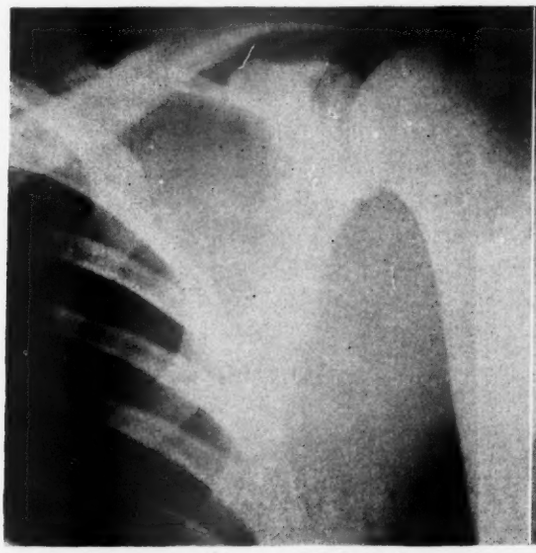

Fig. 1. Simple fracture of the left scapula without displacement.

Fig. 2. Severely displaced and comminuted fracture of the right scapula. *X*-ray on the day of injury.

Fig. 3. Fracture of the right scapula two weeks after instituting skeletal traction with wires through the lower fragment. The wires may be seen in the *x*-ray.

Fig. 4. Right scapula ten weeks after injury showing good union in a moderately improved position.

(Fig. 2.) The roentgenologist described it as follows:

"There is a complete transverse fracture through the middle of the body of the right scapula which is markedly comminuted at its lateral extremity. The inferior fragment is displaced about 3 cm. laterally and inferiorly with ½ cm. separation of the fragments. There is an additional complete fracture through the surgical neck with some comminution, but the distal part of the neck and the glenoid fossa are intact, with no disturbance in the relation of the shoulder joint."

The left scapula was treated by simple immobilization using adhesive tape with a wide

piece running around the chest from front to back just below the axilla and a cross strapping in back over the center of the scapula. The

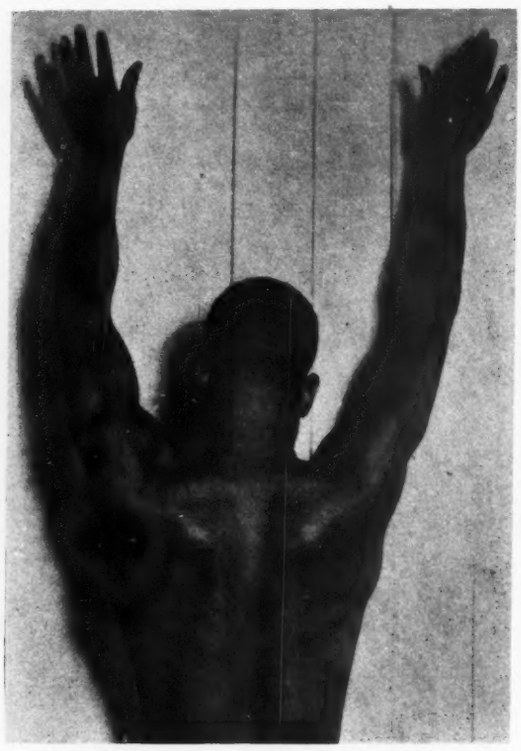

Fig. 5. Photograph showing range of abduction ten weeks after injury.

right scapula was treated for several days with lateral skin traction followed by adhesive immobilization of the upper arm which resulted in no improvement. The patient was taken to the operating room on July 14, 1944, and the following procedure was carried out:

"A two inch diagonally placed incision was made over the vertebral part of the scapula at about the junction of its middle and lower thirds. The border was exposed and two stainless steel traction wires of .025 inch diameter securely applied through holes in the inferior fragment with about ½ inch bite and about two inches apart. The lower wire was about one and one-half inches from the inferior border of the scapula. These wires were brought out through holes in the skin about one inch from the vertebral column running transversely across the back. Sulfanilamide was placed in the wound and it was closed with interrupted sutures of No. 0000 silk."

The patient was returned to the ward and medial traction on the lower fragment instituted, with the lateral traction apparatus set up on the left side of the patient's bed. Ten pounds of weight were used on each of the two wires. In addition the involved arm was put up with ten pounds of adhesive traction made directly lateralward. This was done to make countertraction and to pull the glenoid laterally on the displaced lower fragment. Serial films during the period of skeletal traction indicated a 60 to 75 per cent correction of the displacement and a greater proximity of the fragments. (Fig. 3.)

After five weeks it was believed that maximum improvement had been obtained and the wires were removed on August 26, 1944. Physical therapy was started consisting of short wave diathermy, massage, active and passive motion and circumduction exercises. Function of the shoulder joint approximated 100 per cent by September, 1944, ten weeks after initial injury. (Figs. 4 and 5.)

COMMENT

An analysis of this case in retrospect reveals several observations of interest. There is apparently a very rare incidence of bilateral fracture of the scapula. Remarkably efficient function of the shoulder joint may usually be expected after union in cases with grossly displaced fragments if the fracture line does not involve the glenoid fossa or surgical neck. A great deal of difficulty in correcting the position of the displaced fragments is encountered in this area because of the thick padding of muscle, but at least some correction can be accomplished if direct continuous skeletal traction is made on the displaced fragment itself.

SUMMARY

1. A case of bilateral fracture of the scapula is presented which is the first to be reported in the literature, as far as the authors have been able to ascertain.

2. One of the fractures was badly comminuted and displaced. It was partially reduced by means of traction wires and the position greatly improved.

3. The mechanisms of injury and aspects of treatment are discussed.

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Rapid shallow breathing can be caused by pain of fractured ribs. The condition is dangerous because it leads to anoxia and carbon dioxide retention. The treatment is to relieve the pain either by morphia, by strapping the affected area, or by injecting local anaesthetic into the intercostal nerves in the vicinity of the fractures.

From "Surgery of Modern Warfare" edited by Hamilton Bailey (The Williams and Wilkins Company).

PERFORATED PEPTIC ULCER

A SERIES OF TWENTY-EIGHT CASES

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THE importance of peptic ulcer in the military service in time of war cannot be overemphasized. The adaptability of soldiers who require special dietary management and who are prone to frequent gastrointestinal symptoms is questionable, and the belief exists in many Army medical units that such men are a potential hazard to themselves and the organization. Frequently, soldiers are admitted to the hospital with some serious complication, and not infrequently this may appear as the first sign of the disease. It is the complication of perforation which will be discussed in this report, inasmuch as the condition always commands interest, both in the civilian as well as the Army hospital.

Many comprehensive reports and reviews of perforated ulcers can be found in the literature. Some of the largest series are reported by Thompson (500 cases), Odom and DeBakey (211 cases), Ross and LeTourneau (228 cases), Sangster, Fallis, Read and others. Herbert Willy Meyer reviewed 151 cases of his own in 1940, and in the same year J. Cosbie Ross reviewed 175 cases of the Royal Infirmary of Liverpool. It is not the intention of this report to review the literature, although much can be gained by a study of these large series. Certain factors have maintained a relatively high mortality for the condition which has not been altered appreciably by the advent of the sulfonamides or other recent advances.

At an Army Station Hospital, between January 1, 1941, and November 30, 1943, twenty-eight patients with perforated peptic ulcer were admitted. It is noteworthy that fifteen of these patients were admitted in the eleven months of 1943 under consideration. The relative increase in perforated ulcers can easily be explained on the relative strength reports at time of peace and war with the increased rate of induction of troops within this command. Moreover, the age incidence of those in military life is somewhat lower during mobilization than in peace time. It is generally agreed that peptic ulcer is a disease of young males. Jennings has corroborated this fact in his conclusion that before 1900, three out of six patients with perforation were women under twenty-five, one was an elderly female, one an elderly male, and only one a young male. Since 1920, nine out of ten have been young or middle-aged males. At this hospital most of the patients were between twenty-one and thirty years of age. (Table 1.) The youngest of the group under consideration was nineteen and the oldest thirty-nine. There was but one female, age twenty-five, in the series. Twenty-two of the patients were white and six were colored. Peptic ulcer is not unusual in the colored race and previous reports in the literature would tend to confirm its frequency as equal to that of the white race. During this period there were 92,094

TABLE 1
AGE, RACE AND SEX INCIDENCE OF PERFORATED ULCERS

Age	No. Cases		
20 and under	3	Male	27
21 to 25	8	Female	1
26 to 30	9	White	22
31 to 35	3	Colored	6
36 to 39	3	Youngest	19 years
		Oldest	39 years

admissions to the hospital and 629 patients were admitted with a diagnosis of peptic ulcer. The percentage of perforations in ulcer patients from this analysis alone is 4.4 without making any statistical corrections. (Table II.) The percentage of

TABLE II
INCIDENCE OF PERFORATION IN ULCERS

	1941		1942		1943		Total No.	Total Perf.	Perf. Per Cent
	No.	Perf.	No	Perf.	No.	Perf.			
Duodenum.	120	3	171	5	296	11	587	19	3.2
Stomach.	5	1	14	4	23	4	42	9	21.4
							629	28	4.4

No. of Admissions 1941–1943..... 92,094
Percentage of ulcers..... 0.68
Percentage of perforations..... 0.03

ulcers is 0.68 which compares with other reports in the literature. It is interesting to note that 373 or 59.3 per cent of these patients were discharged from military service by reason of their disability. (Table III.) In contrast, twenty-one of the twenty-six (80.8 per cent) surviving military cases with perforating ulcers were discharged from the Army.

TABLE III
PERCENTAGE OF MILITARY DISCHARGES FOR ULCER

Year	Stomach		Duodenum		All Ulcers		Per Cent
	No. Cases	Disch.	No. Cases	Disch.	No. Cases	Disch.	
1941..	5	1	120	85	125	86	68.8
1942..	14	5	171	57	185	62	33.5
1943..	23	13	296	212	319	225	70.5
Total.	42	19	587	354	629	373	59.3

Most patients were admitted with symptoms of an acute condition of the abdomen. The classical history was one of generalized abdominal pain and vomiting. Pain in these patients was usually sufficiently severe to demand morphine and was frequently referred to the right or occasionally the left shoulder. In three patients the pain was predominant in the right lower quadrant, and it was eventually found that these patients had spillage of intestinal contents into the right abdominal gutter. There was nearly always some degree of rigidity up to the classical board-like abdomen unless the process had been well walled off for some period of time. The skin was usually moist and cold, the pulse moderately rapid. The blood pressure was low and the facies that of an impending catastrophe. Tenderness could nearly always be elicited in the mid or right epigastrium and occasionally in the right lower quadrant. Only eleven of the patients gave a previous history of ulcer symptoms of a year or more, and thirteen of these patients gave no previous history of indigestion prior to the present episode. Some of the histories dated for eight or nine years prior to admission, but no patient in this series had had a previous history of perforation.

The diagnosis of perforated ulcer may be supported by certain laboratory findings. Although all our figures are not available, many of the patients were subjected to upright roentgenograms of the abdomen for the presence of free air under the diaphragms, and several are recalled which showed no evidence of this finding. When present, subdiaphragmatic air is diagnostic. Of twenty-two cases in which hematologic studies were available, eighteen showed elevated white cell counts varying from 12,000 to 19,650, and polymorphonuclear counts varying from 44 to 94 per cent. (Table IV.) The other four patients presented normal blood counts on admission, even though the clinical examination revealed positive evidence of perforation for several hours. These counts varied from 4,000 to 9,050, with polymorphonuclear percentages from 74 to 82, and all except one rose to a pathological height within a few hours. The remaining patient was subjected to operation before a check-up count could be made. In view of the past and present experiences, therefore, we do

not believe that hematologic studies should be given much weight in making an early diagnosis of perforation.

TABLE IV
BLOOD COUNTS IN PERFORATED ULCERS

	Count Variation	Polymorphonuclear Variation, Per Cent
With elevated count		
No cases 18	12,000 to 19,650	44 to 94
With initial normal count		
Case 1	4,000 (1st count)	74
	17,250 (2nd count)	80
Case 2	5,500 (1st count)	79
	9,950 (2nd count)	79
	13,850 (3rd count)	81
Case 3	9,050 (1st count)	82
	13,300 (2nd count)	92
Case 4	8,000 (1st count)	64

Peritoneal aspiration as reported by Steinberg and others has not been performed in any of this series. The diagnosis in all cases was believed sufficiently manifest by the examining surgeon from the clinical data at hand to warrant exploration. In three cases previously mentioned, the diagnosis was suspected to be appendicitis and McBurney incisions were performed. Upon finding a normal appendix and free intestinal contents in the peritoneum, two of these cases were further explored by high right rectus incisions. The remaining patient was operated upon through a transverse extension of the original McBurney incision.

The average time of onset of symptoms to time of operation was 14.3 hours. In Table v will be noted that most of the patients were seen between two and one-half and twelve hours and that most of those with history of perforation over twenty-four hours developed some degree of peritonitis. Of particular interest is a group of cases in which the perforation became temporarily sealed and in which the signs of perforation were not conspicuous. This has been referred by some writers as subacute perforation. This series presented three such cases, and the belief exists that it probably occurs more commonly than statistics would indicate. The size of the perforation is usually small enough that it may be easily sealed by either a fibrinoplastic exudate or by cohesion to an adjoining viscus as liver, other portion of the gut, or even abdominal wall. The degree of spillage of gastric or duodenal content would seem to control the degree of peritoneal irritation present, and such cases may even show signs predominantly localized to the right lower quadrant or right colonic gutter. Such was the case in three of these patients in this group. The process around the ulcer may be sufficiently walled off to prevent a leucocytic response from showing in the blood counts. Other signs as fever, peristaltic movements, and rigidity may be also misleading. Continued tenderness whether localized to the right gutter or epigastric region eventually leads to exploration. Peritoneal aspiration would undoubtedly add much to the diagnosis of this type of case. One patient was so classical of this particular type of pathology that his case is presented in detail:

TABLE V
RELATION OF PERITONITIS TO OPERATIVE DELAY

Delay in hours	2½ to 12	13 to 24	24 to 72
No. cases	22	2	4
No. peritonitis	3	1	3*
Average	14.3 hours		

* 1 death.

CASE REPORTS

CASE 1. (Subacute perforation): G. B., a colored male, age twenty-seven, was admitted 1:30 A.M., November 14, 1943, with severe generalized abdominal pain of four and one-half hours' duration. He stated that his stomach had been hurting him some all week and had received some medicine just twelve hours previously from a doctor at the dispensary. Severe pain did not occur until 9 P.M. It was cramp-like and doubled him up. He vomited twice

soon after its onset. He felt as though his bowels were going to move but experienced no action. After admission he was observed by the medical service and his pain subsided soon thereafter. The past history indicated that he had stomach trouble off and on for about nine years. Sometimes he would experience no discomfort for nearly a year, then would have a spell that lasted a month or two. This abdominal distress was sometimes brought on by eating cold heavy food. He stated that he was told that he had an ulcer in June, 1943, when he consulted a doctor, who restricted his diet to raw eggs and milk, and forbade him from eating meat and drinking whiskey. He never had to stop work because of his disorder, and had never experienced an attack as severe as the present episode. Other than stomach complaint he had never had any sickness except colds. He did have gonorrhea in 1937 and took 70 "shots" for syphilis, the last one being in August, 1943. The doctor who treated this told him his blood and spinal fluid were negative and pronounced him cured.

Due to persistent tenderness in the epigastrium, a surgical consultation was requested and he was transferred to the surgical ward at 1 P.M. on the day of admission. Examination revealed a young colored male, who was mildly tender over the whole abdomen with accentuation in the right lower quadrant and epigastric regions. He was evidently quite comfortable and showed none of the anxiety characteristic of intestinal perforation. Peristalsis was present and apparently normal in quality. Temperature by mouth was 98.8°F. Hematologic studies revealed an initial white cell count of 11,000 with 86 per cent polymorphonuclears. Due to the uncertainty of the diagnosis between possible appendicitis and subacute perforated ulcer, decision was made to observe him further. A Wangensteen tube was inserted into the duodenum, intravenous fluids were started and he remained relatively comfortable. Upright flatplate of the abdomen was unsatisfactory as it did not include the diaphragm level. A second and third white cell count at three-hour intervals revealed subsequent leucocytosis of 10,500 and 16,200 with 80 and 86 per cent polymorphonuclears, respectively. Another upright flatplate of the abdomen revealed a small amount of air under both diaphragms. The abdominal findings were unchanged, the tenderness being only moderately severe in the epigastrium, and with no evidence of rigidity. Peristalsis was still normal.

Twenty-six hours after his first severe symptoms he was taken to the operating room (11 P.M.), and under spinal procaine anesthesia, a high right rectus incision made. Only a small amount of turbid fibrinous peritoneal fluid was present. There was a fibrinoplastic exudate firmly sealing in 4 mm. perforation of the anterior surface of the first portion of the duodenum which was easily closed with interrupted chromic sutures. After implanting 8 Gm. of sulfanilamide into the peritoneal cavity, closure with cotton was effected without drainage. His postoperative course was uncomplicated and he was transferred to the medical service on his twelfth postoperative day for continuation of medical dietary management.

The impending nature of perforation in peptic ulcer does not permit much delay for preoperative preparation. Patients were given, however, intravenous fluids as soon as the diagnosis was suspected, to overcome the loss of fluid and electrolytes through repeated vomiting. None of the patients in this report suffered hemorrhage with perforation and blood transfusion or plasma administration was seldom deemed essential. The anesthetic of choice was spinal procaine inasmuch as most personnel were sufficiently acquainted with its use and it afforded adequate relaxation for the period of time usually required for this type of laparotomy. DeBakey has reported moreover, that the mortality in perforated ulcer laparotomies is generally lower with spinal than with other forms of anesthesia.

The ulcer at the time of operation was found to be in the stomach in nine cases and in the duodenum in nineteen. The duodenal lesions were all in the first portion of that organ on its anterior surface. In the stomach cases seven were anterior and prepyloric, one was on the lesser curvature and one on the greater curvature. The average size of perforation was described as varying from 2 to 6 mm., but one case presented a 5 cm. perforation. The size of the perforation, it is believed,

is not of particular importance but in the latter case, death resulted from widespread peritonitis.

Case II. (Perforation with fatal peritonitis): H. C. B., a thirty-five year old white male, entered the hospital June 13, 1943, with epigastric pain. He had a past history of indigestion for six to seven years for which he had taken soda. The pain for which he had become hospitalized began twenty-four hours prior to admission and was fairly severe. It was not relieved by either soda or food and he had vomited several times. He was observed by the medical service and given a soapy enema in an effort to correct a mild distention. The abdomen to the examiner was not rigid but was extremely tender in the epigastrium. No note was made of peristalsis. Hematology studies revealed 5,500 white blood cells and 79 per cent polymorphonuclears. His progress during the next twelve hours was steadily worse. Tenderness increased and rigidity became apparent. By the eighteenth hour, he was in shock with cold clammy skin, pulse of 126, blood pressure 70/40 and classical Hippocratic facies, and a surgical consultation was requested. It was apparent that he then had a perforated peptic ulcer. Check-up hematology revealed 13,850 white blood cells with 81 per cent polymorphonuclears and an upright roentgenogram showed free air under both diaphragms.

With the administration of 1,000 cc. of whole blood by transfusion, a high right rectus incision was made under local anesthesia. Between 4,000 and 5,000 cc. of bile-stained fluid were removed from the peritoneal cavity. This fluid contained particles of gastric content. A 5 cm. perforation was found on the greater curvature of the stomach surrounded by a plastic exudate. Closure by interrupted silk sutures was quickly effected, 10 Gm. of sulfanilamide implanted intraperitoneally, and Penrose drains placed in the peritoneal cavity before layer closure of the wound.

His postoperative convalescence was steadily downward despite transfusion and other intravenous fluids. Oxygen therapy was given by B.L.B. mask and 4 cc. eschatin given intramuscularly. He expired thirteen hours following the operation. Autopsy revealed scattered areas of atelectasis in both lungs with early bronchopneumonia, but the evident cause of death was widespread peritonitis.

The ulcer in 7 patients was still emptying intestinal contents at the time of exposure but the usual finding was a natural but inadequate attempt at closure of the opening by a plastic exudate. All patients had varying amounts of free peritoneal fluid and in some, the fluid showed evidence of turbidity.

The operation in all cases was simple closure of the ulcer and only three patients were subjected to rubber tissue drainage of the peritoneal cavity. The closure was usually effected by interrupted fine chromic catgut, silk, or cotton, or occasionally a purse-string suture if the borders of the ulcer were not too friable or edematous. The ulcer was frequently so indurated that it was difficult to insert sutures that would not tear the serosa unless large bites were taken. The simplest method in this type of ulcer was to bend the ulcer on itself and suture adjacent walls of the organ together over it. Usually a tag of omentum or a free omental graft was placed over the site of closure. Twenty-two of the patients had sulfanilamide implanted in the peritoneal cavity in amounts varying from 4 to 12 Gm. This was always supplemented by oral or intravenous administration of some form of sulfonamide after the first twenty-four hours postoperatively. The peritoneal administration of the drug was believed to give an adequate initial concentration during the time that the patient was unable to tolerate oral administration.

Postoperative care consisted in prompt institution of continuous gastroduodenal drainage by the method of Wangensteen. By the use of this tube, patients were able to take small amounts of water after forty-eight hours, the excess flowing through the tube. The tube was usually removed permanently in three to four days when the patient was able to expel flatus voluntarily. Fluid requirements were met religiously, the usual minimal amount being 4,000 cc. daily, half of which was normal saline solution. As the oral intake increased, the intravenous requirements diminished

so that patients were usually able to sustain themselves by the fourth postoperative day. On the latter date Sippy management was usually instituted and continued faithfully until the patient was transferred to the medical service. Patients with uncomplicated convalescence were transferred to medical convalescent wards by the ninth to the twelfth postoperative day.

In patients with peritonitis in whom prolonged administration of parenteral fluid was required or in whom food balance was lacking, vitamins and proteins were instituted as recommended by Holman. Cevitamic or ascorbic acid, 100 mg. daily, was the basis for the required vitamin C intake. There was one case of wound disruption in which the drug was not used and this may or may not have influenced this complication. Protein requirement was supplemented by parenteral plasma injections of 250 cc. daily or 500 cc. on alternate days. No patient in this series of cases was sufficiently anemic or hypoproteinemic from perforation alone to justify transfusion of whole blood, but our fatal case received blood for severe shock.

TABLE VI
COMPLICATIONS OF PERFORATED ULCERS

	No.	Per Cent	Died
Peritonitis (clinical)	7	27.7	1
Phlebothrombosis (femoral)	1	3.9	0
Wound disruption	1	3.9	0
Pneumonia (postatelectatic)	3	11.5	0
Empyema (postpneumonic)	1	3.9	0

One cannot overemphasize the necessity of frequent change of position postoperatively in perforated ulcer patients. The incidence of atelectasis and pneumonia in this series (Table VI), as in others, rises easily in a patient with a high rectus incision who is unwilling to cough. Prompt attention is recommended to all who develop atelectasis with particular emphasis on deep breathing, voluntary cough, and even tracheal suction or bronchoscopy if indicated. Morphine is given in sufficient amounts to allay pain but not sufficiently to reduce the respiratory rate appreciably or to produce constant somnolence. The following case is given in some detail inasmuch as it portrays certain complications which are commonly seen:

CASE III. (Perforation with postoperative empyema): Mrs. B. P., a white female age twenty-six, entered the hospital January 8, 1943, with pain in the lower right anterior thorax which had been present some twelve hours prior to admission. She stated that she had not felt well for the past three weeks and had a chest cold which persisted. There was no true gastrointestinal past history. Examination revealed a patient who appeared ill with slight cyanosis, temperature of 102.4°F., and with grunting respirations. Examination of the chest revealed râles and diminished breath sounds over the right base. There was a definite pleural friction rub over the anterolateral aspect of the fifth right interspace. Rigidity of the upper abdomen was present and the patient exhibited moderate tenderness in the entire epigastrium. She vomited soon after admission and a Wangensteen tube was inserted for apparent distention. A flatplate roentgenogram of the abdomen in the upright position was negative for subdiaphragmatic air and the film confirmed the finding of atypical pneumonia in the right lower lobe. She was placed in an oxygen tent and given sulfonamides and intravenous fluids.

After ten hours, due to the persistence of abdominal rigidity and tenderness, she was taken to the operating room where a high right rectus incision was made under spinal pontocaine anesthesia. The peritoneal cavity was filled with 1,200 cc. of turbid fluid, and showed evidence of a plastic exudate over the anterior duodenum lightly sealing a small perforation. Closure was easily effected by interrupted silk sutures, 8 Gm. of sulfanilamide implanted intraperitoneally, and returned to the ward in fair condition. The patient continued to run a fever to 102°F. after the third postoperative day and check-up roentgenogram of the chest revealed an increase in involvement in the right lower lobe and a new process in the left lower lobe. A blood transfusion of 500 cc. was given to aid the patient's resistance. By the twelfth

postoperative day it was evident that all her pathological symptoms were limited to the chest as the incision was well healed and she had been taking a diet without any abdominal symptoms. On January 31st, due to the finding of dullness over the left lower thorax, and due to a subsequent finding of pus on aspiration, a thoracostomy was performed under local anesthesia, resecting a portion of the eighth left rib posterolaterally. About 800 cc. of pus were recovered and the drainage tube was placed into an under-water trap. By February 5th, there was evidence of dullness over the right base as well as a persistence of fever to 101°F. Aspiration revealed turbid fluid and 250 cc. were removed. Three subsequent aspirations were successful in obliterating the right-sided effusion and she became afebrile. Her thoracostomy wound and pleural sinus closed and she was discharged from the hospital February 21, 1943. She was seen again December 6th when she was complaining of moderate epigastric distress following meals over the past two months. Check-up roentgen studies of the stomach and duodenum showed pyloric obstruction. On January 13, 1944, a subtotal gastric resection was performed. The specimen revealed a chronic duodenal ulcer, adherent to the abdominal wall, with considerable surrounding edema. Postoperative convalescence was uneventful except for a transient hemolytic jaundice resulting from a transfusion reaction. She was discharged, asymptomatic on her twenty-first postoperative day.

CONCLUSIONS

1. A series of twenty-eight perforated peptic ulcer cases is reviewed in which there was but one death or a mortality of 3.57 per cent.

2. Although the series is small, the incidence of perforated ulcers in this military hospital is 0.03 per cent of all hospital admissions. The incidence of all peptic ulcers in this hospital corresponds to civilian figures, and is 0.68 per cent of all hospital admissions.

3. Of all peptic ulcers admitted to this Station Hospital during 1941 to 1943, 59.3 per cent were discharged from military service, while the percentage of perforated ulcers discharged from the service was 80.8 per cent.

4. A small but definite group of cases of subacute perforation is emphasized inasmuch as it is believed that the condition exists more often than figures would tend to indicate. One classical example of this type of case is presented in detail.

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CIRCUMSCRIBED POST-TRAUMATIC OSTEOPOROSIS OF THE LOWER ENDS OF THE RADIUS AND ULNA

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D. La M., a forty-five-year old white Brazilian male, was seen by the writer for the first time on October 18, 1944, because of a disability resulting from an injury to his left wrist. He stated that one year previously (October 15, 1943), a part of a gyro weighing about fifteen to twenty pounds fell a distance of several inches and struck the palmar surface of his left wrist pinning it against the top of his work bench. He experienced immediate pain and thereupon stopped working. Four days later he was seen by a physician who found that the left wrist joint was deformed in that there was anterior bowing of the lower end of the ulna accompanied by widening of the wrist. The acute condition was diagnosed as a contusion and sprain of the wrist joint.

Notwithstanding that physiotherapy was administered, the patient's condition grew worse. He therefore placed himself on October 29, 1943, under the care of a second physician complaining of a painful swollen lower portion of the forearm, numb fingers and weakness of the grasping power. Examination at that time revealed swelling and tenderness over the volar aspect of the distal portion of the forearm, subluxation of the head of the ulna anteriorly, limitation of all motions of the wrist, tenderness over the carpal canal, weakness of flexion of the fingers, and numbness of all fingers. More physiotherapy was administered without any evident improvement.

The patient was therefore seen by a neurologist on November 26, 1943. The latter found a swelling on the ulnar nerve above the wrist. He further noted that the left hand was colder and clammier than its mate. His impression was that the patient was suffering from a traumatic neuritis of the ulnar and median nerves. About three weeks later the patient was found to have less swelling over the lower end of the ulna, marked tenderness over this area, pain and limitation of all motions of the wrist, limitation and weakness of flexion of all fingers, hypesthesia of the second, third, fourth and fifth fingers in ulnar and median nerve distribution and slight swelling of the palm.

Continued therapy gave no relief. A fourth physician was consulted on May 9, 1944. The latter found complaints of weakness, defects, and pain on all motions of the hand and wrist and numbness of the third, fourth and fifth fingers. His examination revealed a large and irregular head of the ulna, pain on supination and pain and limitation of pronation of the forearm, pain and limitation of all motions of the wrist, and weakness of motion of the fingers apparently due to apprehension. There was no atrophy of the intrinsic muscles of the hand and the circulation was good. There was hypesthesia of the volar aspect of the ulnar side of the wrist and the palmar aspects of the third fourth and to a lesser extent the fifth finger. This consultant believed that the patient was suffering from a long standing mechanical disturbance of the radio-ulnar joint and a disappearing disturbance in the sensory distribution of the ulnar nerve and a small part of the median nerve. He therefore advised a subperiosteal resection of the head of the ulna. This was performed on May 23, 1944. The resected specimen was unfortunately discarded without a microscopic study. Subsequent to his discharge from the hospital on June 23, 1944, no further treatment was administered.

When the patient came under the writer's observation on October 18, 1944, he complained of three or four recurrent attacks of swelling of the left hand lasting about twenty-four hours each accompanied by severe pain. He further complained of pain of the hand and forearm on all their aspects, weakness of the hand and a clicking sensation of the forearm on pronation and supination.

Examination revealed that the patient was apparently in good general condition though somewhat apprehensive. There was no evident involvement of the left shoulder or elbow. Supination of the forearm was slightly restricted and painful when forced. Pronation

was only possible to about half the normal range of motion and was accompanied by a click and sharp pain. The lower end of the ulna had apparently been removed and there was localized tenderness over its distal end. Passive manipulation of the ulna in an anteroposterior direction produced pain. There was considerable perspiration of the left hand, more so than of the right. The skin of the palm and fingers was smooth and velvety. Aside from weakness there was no involvement of the intrinsic muscles of the hand. All motions of the wrist were unrestricted though somewhat painful at the extremes. All motions of the fingers were unrestricted and painless. The grasping power of the hand was diminished. There was hypesthesia to touch and scratch of the lower two-thirds of the forearm, wrist, hand and fingers. The left arm was atrophied ½ inch, the forearm, wrist and palm ¼ inch.

Fig. 1. D. La M., circumscribed post-traumatic osteoporosis of lower end of ulna, radius, and carpal bones. Note: (1) Non-union of styloid process of ulna; (2) rounded areas of rarefaction in styloid process of ulna, distal ends of ulna radius and of os magnum and unciform; (3) mushroom-shaped deformity of distal end of ulna; (4) preponderance of sparse, coarse longitudinal bone lamallae over transverse lamallae in carpus and adjoining metaphyses.

Examination of roentgenograms (Fig. 1) made on October 25, 1943, and October 28, 1943, ten and thirteen days after the above described injury revealed that the styloid process of the ulna was un-united. Its border was well demarcated and smoothed. The styloid process presented three smooth round areas of rarefaction. The distal end of the ulna also revealed several rounded areas of rarefaction and was deformed and somewhat mushroom-shaped. The distal end of the ulna presented at its radial surface a parrot-beak formation. The bony architecture revealed a preponderance of longitudinal lamellae with a diminution of the transverse lamellae. The distal portion of the radius revealed several small areas of rarefaction. The lower portion of the shaft as well as the metaphysis presented the preponderance of the coarse longitudinal striae noted in the ulna. The carpal bones especially the os magnum and the unciform presented small rounded areas of rarefaction. The bony lamellae were sparse, coarse and accentuated and were longitudinally arranged. This was also true of the proximal metaphyses of all of the metacarpal bones.

Roentgenograms made on May 25, 1944, revealed that the distal 1 to 1½ inches of the

ulna had been surgically removed. Two small fragments of bone remained at the site of the distal end of the ulna. One of these because of its size, shape and contour was apparently the un-united styloid process of the ulna. The bony architecture previously described was still apparent.

Roentgenograms made on August 31, 1944, and on November 16, 1944, reveal an essentially similar appearance.

Physiotherapy was instituted by the present author and great stress was placed upon the functional use of the hand on all possible occasions. In addition the patient was constantly reassured of an eventual satisfactory outcome. Recovery has been slow but progressive though not as yet complete.

The interest in this case centers about the nature of (1) the localized bone changes in the os magnum and unciform, and in the distal end of the ulna, the deformity of the head of the ulna, its ununited styloid process and the distal end of the radius; (2) the diffuse bone changes characterized by the sparsity and coarseness of bone lamellae and preponderance of longitudinal lamellae in the carpal bones and adjacent metaphyses; and (3) the clinical picture presented subsequent to the injury of October 18, 1944.

Repeated questioning of the patient has resulted in denials on his part of any preceding injury or symptom complex referrible to the left wrist. The roentgenographic findings are nevertheless indicative of a long standing disturbance of the bony architecture of the involved parts antedating the present injury. These seemingly contradictory facts are, however, not at variance with a circumscribed post-traumatic osteoporosis of the separated styloid process, the head of the ulna and the lower end of the radius and the os magnum and unciform, very much akin to the similar though more common process occurring in the carpal semilunar (Kienbock's disease) and the carpal scaphoid (Preiser's disease). The present author has had the occasion to describe this condition in the os magnum and the unciform.[1] Esau[2] and others have since made similar observations. King[3] was the first to describe this condition in so far as it affects the distal end of the ulna. Both of his cases present an identical appearance to that described in the case under discussion. King's second case gave "no history of recent injury to the region, but there was definite evidence of the separation of the styloid process and some irregularity of the head of the ulna. The condition was discovered accidentally when the wrist was *x*-rayed on account of a recent injury to the radial side of the hand."

The second point of interest in this case is the sparsity and coarseness of bone lamellae and the preponderance of the longitudinal lamellae in the carpus and the adjacent metaphyses. This appearance is the characteristic end result of the diffuse post-traumatic osteoporosis frequently described as Sudeck's atrophy. The author has noted several such instances one of which he has had occasion to describe in detail.[4] The following case report clearly demonstrates the roentgenographic appearances in Sudeck's atrophy as well as the characteristic end result.

Charles F. P., a fifty-year old white male sustained, as a result of an automobile accident on April 15, 1936, a fracture of the lower end of the right radius without displacement of the fragments. An anterior molded plaster of Paris splint was applied and subsequently removed at the end of three weeks. It was noted at this time that he had great pain and stiffness in his hand and fingers. In addition he began to experience at this time pain and limitation of motion in the right shoulder. Physiotherapy was administered without any apparent relief.

The patient was seen by the author on August 26, 1936, when the skin of the right hand and fingers was found to be velvety, shiny and atrophic. There was inability to make a fist and the grasping power of the hand was considerably diminished. The thenar and hypothenar eminences were atrophied. All motions of the fingers and wrist were greatly restricted and painful at the limits of motion. The forearm, elbow and lower two-thirds of the arm were clinically uninvolved. There was pronounced atrophy about the shoulder joint. The anterior aspect of the joint area was tender.

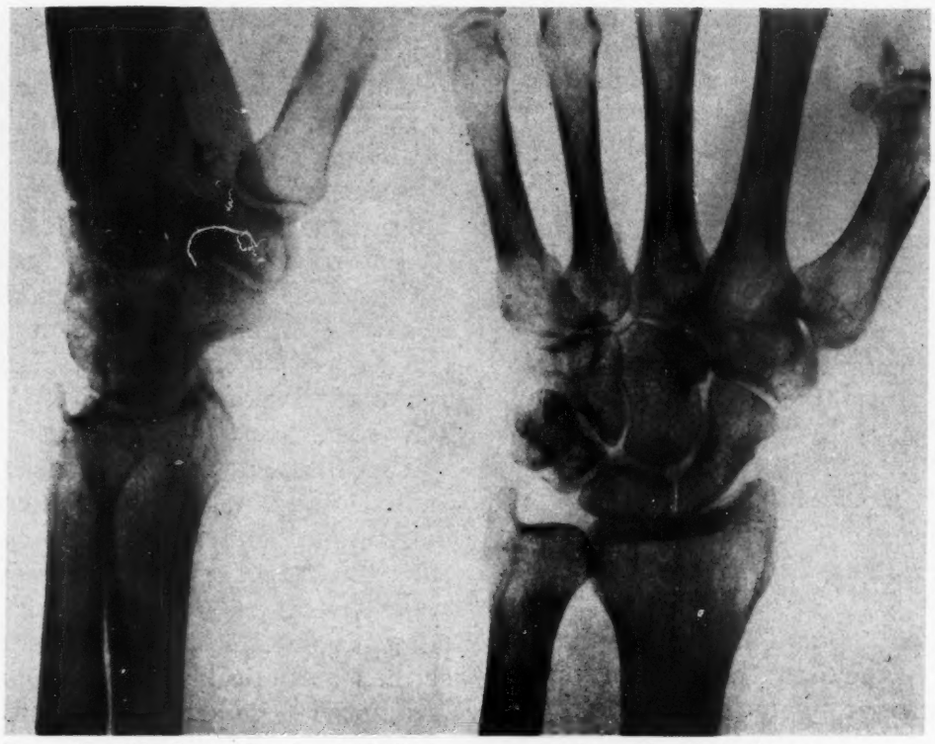

FIG. 2. C. F. P., September 8, 1936, diffuse post-traumatic osteoporosis of wrist. Note. (1) Pronounced punctate areas of rarefaction in the carpus, adjacent metaphyses, and metacarpals; (2) early appearance of coarse longitudinal bone lamallae.

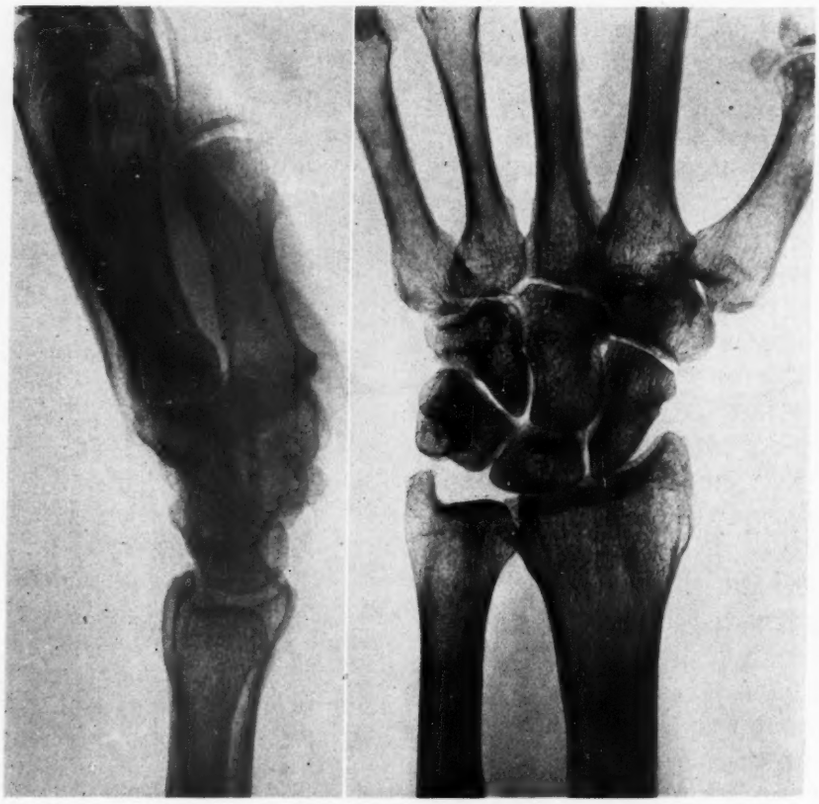

FIG. 3. C. F. P., October 9, 1938, end result of diffuse post-traumatic osteoporosis shown in Figure 2. Note preponderance of coarse sparse longitudinal bone lamallae over transverse lamallae.

All motions, active and passive, at the glenohumeral articulation were for all practical purposes absent and painful.

Examination of roentgenograms (Fig. 2) made on September 8, 1936, five months after the accident, revealed faint traces of a healed fracture of the lower end of the radius without any displacement of the fragments. The distal ends of the radius and ulna, all of the carpal bones, the metacarpals and the phalanges showed pronounced punctuate areas of rarefaction. In the carpal bones and to a lesser extent in the other parts coarse longitudinal trabeculae were already evident. Roentgenographic examination of the shoulder revealed punctate osteoporosis of the head and upper portion of the humerus, the distal end of the clavicle, and the acromion and the neck and glenoid portion of the scapula.

Physiotherapy in the form of baking, diathermy and massage was administered together with gradually increasing active function. After a period of four months of additional therapy the patient was completely relieved of his symptoms save for some residual stiffness of the fingers. His clinical course lasted about a total of nine months.

A roentgenographic examination of the right wrist (Fig. 3) made on October 29, 1938, thirty months subsequent to the accident revealed that the involved parts have been recalcified. The architecture of the bone was coarse and sparse with a predominence of the longitudinal as against the transverse lamellae.

The third point of interest in this case is that the recent clinical symptom complex is characteristic of Sudeck's atrophy with the exception that during the present disturbance no new osteoporosis has developed.

King,[3] in his monumental monograph on "Rarefying Conditions of Bone" which won for him the Jacksonian Prize of the Royal College of Surgeons, has emphasized the close relationship of the diffuse form of post-traumatic rarefaction of bone as exemplified by Sudeck's bone atrophy and Kummel's disease and other more uncommon forms and the circumscribed form of post-traumatic rarefaction of bone as exemplified by Kienboch's disease, Preiser's disease and the rarer forms such as the instance under discussion. The present writer as well as other investigators have seen and described instances in which both forms have occurred in the same part either simultaneously or at intervals apart. The following case report is an excellent example of a long standing circumscribed osteoporosis upon which a diffuse osteoporosis has been superimposed at a later date.

Harry H., a twenty-five-year old white male, stated that while simonizing a car on November 20, 1940, his right hand slipped and his wrist struck against a bumper guard. He experienced immediate pain and swelling of the wrist but continued working with his left hand. On the following day he complained of severe pain in the right wrist. He was therefore referred to a physician and was discharged from his job. Physiotherapy was administered but the pain and disability persisted and was sufficiently severe to prevent him from working for two months. Thereafter he returned to light work which was performed chiefly with his left hand.

There was an additional history of an injury to the knuckle of the right index finger about eight or ten years previously. No treatment was ever administered for this condition.

When I saw the patient four months after the injury he complained of pain and weakness in the right wrist on working and pain at night.

Examination revealed a complete loss of dorsiflexion of the wrist. Palmar flexion was restricted to 150 degrees, and ulnar and radial deviation were only possible to a few degrees. The extremes of all motions of the wrist as well as pronation and supination of the forearm were painful. The tenderness which was present over the entire wrist was greatest over the semilunar and cuneiform bones. The prominence of the knuckle of the index finger was diminished. The grasping power of the hand was greatly lessened. The arm and forearm were somewhat atrophied.

Examination of a roentgenogram (Fig. 4) made seven days after the accident revealed a punctate osteoporosis involving the entire carpus, the distal ends of the radius and ulna and the proximal ends of the metacarpal bones. The semilunar was sclerotic, deformed and fragmented. The cuneiform was markedly

porotic. The head and neck of the second metacarpal were deformed and displaced.

It therefore appeared to the author that the patient was suffering from a diffuse post-traumatic osteoporosis of the entire carpus and adjacent bone structures superimposed upon a previously existing circumscribed post-traumatic osteoporosis of the semilunar bone, otherwise known as Kienboch's disease.

Fig. 4. H. H., November 27, 1940, circumscribed post-traumatic osteoporosis of semilunar and diffuse post-traumatic osteoporosis of wrist. Note: (1) Fragmentation, deformation and sclerosis of semilunar bone; (2) diffuse punctate osteoporosis of carpus and adjacent metaphyses.

Immobilization in a circular plaster of Paris bandage from the metacarpophalangeal joints to the elbow was advised and applied from time to time over a period of eighteen months from the date of the accident. Examination on May 1, 1942, revealed that all motions of the wrist were greatly restricted, the extremes of motion were painful, and the tenderness save that over the semilunar had disappeared.

Radiographic examination made on April 28, 1942, demonstrated that the diffuse punctate osteoporosis had disappeared. The lamellar structure of the previously involved areas showed a considerable diminution in the transverse elements while the longitudinal elements were coarse and sparse. The deformity of the semilunar bone was increased and the joint spaces, especially the radiocarpal, were more diminished in size when compared to the original film.

Fig. 5. H. H., November 20, 1942, end result of circumscribed and diffuse post-traumatic osteoporosis shown in Figure 4. Note: (1) Preponderance of coarse though sparse longitudinal lamallae and relative diminution of transverse lamallae; (2) increased deformity of semilunar bone and persistent fragmentation and sclerosis; (3) diminution of joint spaces; (4) disappearance of punctate osteoporosis.

Gradual mobilization of the wrist and physiotherapy were advised and instituted. A further roentgenographic study two years after the accident (Fig. 5) demonstrated the above described changes more clearly. Clinically, however, there were residual changes such as pronounced limitation of motion, pain on extremes of motion, tenderness and weakness which were indicative of arthritic changes. The prognosis was therefore poor even though the diffuse post-traumatic osteoporosis had subsided.

Both the circumscribed as well as the diffuse form of post-traumatic osteoporosis are thought to be due to a functional dis-

turbance of the vasomotor mechanism of the parts involved and are merely expressions of degree of involvement. In these forms the osteoporosis and the resulting after-effects such as loss of motion and deformity are the prominent symptoms. In other forms the osteoporosis may be minimal or non-existent as exemplified by the present case history under consideration. All of these forms are closely related and vary only in that one or another aspect may become predominant in the clinical picture even though all of these forms have many of the clinical features in common.

Because of this variance in one or another phase of the condition under consideration, the terminology has been varied even though they all refer to what is in all probability the same condition. The more common terms employed in the literature are Sudeck's bone atrophy, acute bone atrophy, post-traumatic osteoporosis, reflex dystrophy of the extremities, reflex nervous dystrophy, segmental angiospasm, and minor causalgia.

CONCLUSION

The purpose of this presentation is:

1. To demonstrate a very rare form of circumscribed post-traumatic osteoporosis of the lower end of the ulna and radius associated with similar changes in the os magnum and cuneiform akin to the better known localization in the semilunar bone (Kienbock's disease) and scaphoid (Preiser's disease).

2. To demonstrate the occurrence of the circumscribed form and the diffuse form of osteoporosis (Sudeck's atrophy) in the same patient as manifested by the characteristic bone changes incidental to the recovery from both conditions.

3. To demonstrate the relationship between the circumscribed and diffuse forms of post-traumatic osteoporosis on the one hand and the clinical syndrome (reflex dystrophy of the extremities) which is very much akin to the diffuse form of post-traumatic osteoporosis with the exception that the bone changes may be minimal or entirely absent on the other hand, thus demonstrating that these three forms of functional disturbance of the vasomotor mechanism of the parts involved are merely expressions of degree of involvement.

4. To demonstrate the occurrence of the three forms of vasomotor disturbance in the same part of the same patient at different times, probably indicating an inherent susceptibility of the individual under consideration.

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TUBERCULOSIS OF THE THIRD PORTION OF THE DUODENUM

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ONE of the rarest conditions encountered in the abdomen is tuberculosis limited to a small segment of the duodenum. There are less than a dozen proven cases reported in the literature. The finding of this pathological condition is usually a pleasant surprise for invariably the preoperative diagnosis is malignancy and malignancy in this region means involvement of the pancreas, so that one ordinarily operates and expects either to undertake a formidable operative procedure, such as removal of the duodenum and head of the pancreas, or else he will perform a short circuiting operation such as a gastrojejunostomy. When the diagnosis of tuberculosis is made, a resection of the involved bowel with either an end-to-end or side-to-side anastomosis is all that is necessary and the prognosis is not as grave as it is in carcinoma. The following is such a case in which the patient was operated upon by me one year ago:

CASE REPORT

Mr. S. S. was admitted to the Rhode Island Hospital on March 3, 1943, with a diagnosis of carcinoma of the third portion of the duodenum. The history reveals that he had had "stomach trouble" for four months. At the onset there was intermittent colicky pain over the lower abdomen which later settled in the mid-epigastrium. The pain was not referred to the shoulder or back.

The pain usually followed meals. "Fat and fried food were no worse than others." More food or alkali would not relieve the symptoms but usually aggravated the condition. As time went on the heavy food would "stay on my stomach for a long time," reported the patient and then vomiting would bring relief. During the last month only liquids such as "milk and soups would stay down." He had not noted any blood in vomitus or stools although he admitted rarely looking for bloody or tarry stools. During the last three months he had lost eleven pounds.

The past history, family history and physical examination were entirely negative. A gastrointestinal series had been performed previous to admission and was repeated in the hospital. The reports follow:

December 28, 1942: "Examination of the gastrointestinal tract shows normal esophagus. Stomach was normal in position and had a smooth contour. Peristalsis was normal and there was no delay in the emptying time. The duodenal bulb was well outlined and showed no pathology. A short segment of the duodenum at the junction of the second and third portion was narrowed and irregular in outline. The mucosal pattern was obliterated in this area and there was a sharp delineation between the involved and normal intestine. There was considerable delay in the passage of barium in this region and the descending duodenum proximal to the point of narrowing was dilated and showed reverse peristalsis at the fluoroscopic examination. At the four-hour examination there was a small amount of residual barium in the second portion of the duodenum. Otherwise, there was normal motility in the small intestines and the barium had reached the transverse colon. At the twenty-four-hour examination the cecum and colon were not remarkable. Two examinations were made of the gallbladder by the oral method and showed a normal functioning gallbladder. There were no calculi.

"Conclusion: Examination reveals a narrow irregular sharply delineated defect at the proximal end of the third portion of the duodenum which is consistent with malignancy."

March 5, 1943: "Examination of the gastrointestinal tract showed the stomach in good position and of normal outline. Peristalsis was normal. There was no delay in the emptying time. There was marked narrowing of a small segment of the proximal end of the ascending or third portion of the duodenum. There was a sharp line of demarcation between the involved and normal intestine in this area. The second portion of the duodenum was dilated and there was reversed peristalsis present. The findings are due to an obstructive lesion in the proximal end of the third portion of the duodenum, as previously noted."

March 24, 1943: "Examination of the chest shows no infiltration in the upper lobes or other pathology in the lungs. The diaphragm shadows are of normal outline. The heart and great vessels are within normal limits."

The laboratory findings were as follows: Hinton test, negative; hemoglobin, 16; red blood count, 5,870,000; white blood count, 8,550; differential: polymorphonuclears, 67; eosinophils, 2; small leucocytes, 24; large leucocytes, 7; urea nitrogen, 18; glucose, 90; sodium chloride, 454; total protein, 7.6; gastric analysis, within normal limits.

Preoperative diagnosis: Obstructing lesion of the third portion of the duodenum, probably carcinoma.

Operation was performed on March 10, 1943, under fractional spinal anesthesia. An upper right rectus muscle-splitting incision was made. Exploration of the stomach and of the first and second portion of the duodenum revealed no pathological disorder. There was a questionable induration of the head of the pancreas, although this was not marked. The transverse colon and omentum were lifted so as to expose the ligament of Trietz. The jejunum appeared to be normal. In the third portion of the duodenum (the retrocecal part) a soft mass could be felt. There was no apparent extension into the surrounding tissues. In the mesentery of the small bowel, at the ligament of Trietz, there were several hard glands. One of these was removed and a frozen section was reported as tuberculosis. The small bowel, just beyond the ligament of Trietz, was clamped with Payr clamps and severed with cautery. The distal end was covered over with gauze to prevent contamination. The proximal clamp was covered with a gauze sponge.

An incision was made in the ligament of Trietz to release this portion of the duodenum. Another incision was made in the peritoneum so as to give better exposure of the retroperitoneal area. The mesentery of the duodenum was clamped, cut and tied, and with moderate difficulty, the duodenum was freed from the surrounding structures, until normal duodenum could be seen for some distance proximal to the lesion. Clamps were placed here and a segment of the duodenum approximately three to four inches in length was removed with cautery. Examination showed that we were at least an inch or more on either side of the lesion. A basting stitch of dermal No. 00 on an atraumatic needle was applied to both ends of the cut bowel. The clamps were removed. The two segments were approximated and an aseptic anastomosis was performed using an outer row of No. C silk mattress sutures and an inner row of continuous extra hard chromic No. 00. The dermal sutures were pulled out and the anastomosis was opened with a finger on either side of the stoma. There was a good opening. The posterior peritoneum was then sutured so as to make this part of the duodenum retroperitoneal.

About 2 Gm. of a mixture of equal parts of sulfathiazole microcrystals and sulfanilamide were applied in the retroperitoneal area. About 3 Gm. were placed in the general peritoneal cavity, and about 1 Gm. in the abdominal wall. Exploration of the remainder of the abdomen showed no evidence of disease either in the bowel or the mesentery.

The wound was closed in layers without drainage, using chromic No. 00 doubled continuous to the peritoneum, interrupted figure-of-eight chromic No. 0 in the fascia, interrupted silk in the skin and five stay sutures.

A transfusion was given during the operation.

Postoperative diagnosis: Deferred (pathological diagnosis was tuberculosis of this portion of the duodenum).

The pathological report submitted by Dr. B. Earl Clarke and checked by Dr. S. Burt Wolbach of the Harvard Medical School follows:—

Organ: Duodenum—third portion.

Duration: Five months.

Clinical History: Epigastric distress and some obstruction for four months.

Gross Description: The specimen consists of a segment of duodenum 7 cm. in length. It has already been opened. The circumference

at what appears to be the distal end is 6 cm. This is reduced at the opposite end over a distance of 4 cm. to a circumference of 3.5 cm. The mucosa of the narrowed portion has lost its folds. It is hemorrhagic and very superficially eroded. On section the muscular wall here appears to be somewhat thicker than in the normal part. The fibrous tissue between the muscle and the mucosa is especially thickened and more dense and white than in the normal portion. The thickness here of the entire wall is 6 mm. as compared to 3 mm. normal. The external surface is torn and ragged but in one or two fairly smooth areas a smooth tiny translucent tubercle-like nodule is visible when the specimen is rotated so as to reflect the light. There is also submitted a lymph gland measuring about 1 cm. in diameter. Frozen section of this is done and shows tuberculosis.

On the following day there was received a small segment of duodenum from the same patient. It shows considerable postmortem degeneration.

Microscopical description: Sections from all of the seven blocks potted and from the lymph gland show typical tubercles and giant cells. Some of the larger lesions show necrosis and caseation.

Diagnosis: Tuberculosis of duodenum and regional lymph node.

The postoperative course was unusually smooth, the pulse never going above 90 and the temperature returning from a high of 101°F. to normal on the fifth day. The treatment consisted of gravity drainage of the stomach through a Levine tube for forty-eight hours then sips of water for twenty-four hours. A fourth day Balfour diet was then started with the usual progression. Intravenous fluids were given daily in amounts sufficient to maintain a 1,500 cc. urinary output. The patient was allowed up on the twelfth and discharged on the fourteenth postoperative day.

Mr. S. S. returned to work after eight weeks and has enjoyed good health. He has had ultraviolet light to his abdomen and the usual vitamins. He eats all foods without any signs of gastric distress and has gained approximately twenty pounds since his operation.

Check-up *x*-rays were taken and the report follows:

May 20, 1943: Repeat examination of the gastrointestinal tract shows the stomach in good position and of normal outline. There was no disturbance in the peristalsis or delay in the emptying time. The first and second portions of the duodenum were well outlined and had a normal pattern but there was slight dilatation of a small segment of intestine at the site of the anastomosis, but there was no delay or obstruction to the flow of barium at this point. Other portions of the duodenum and jejunum were of normal calibre.

ISCHIOFEMORAL ARTHRODESIS WITH PSEUDOARTHROSIS*

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IT is the purpose of this paper to present the clinical result of an ischiofemoral arthrodesis in which union took place between the upper femoral fragment and the bone graft, while a pseudoarthrosis developed between the bone graft and the inferior femoral fragment.

FIG. 1. Roentgenogram of the hip prior to surgery.

FIG. 2. Roentgenogram showing the graft and the position of the fragments six months after surgery.

CASE REPORT

The patient, a forty-three year old Italian male, was first seen in the Orthopedic Clinic in February, 1943. His chief complaint at that time was constant severe pain in his right hip which had persisted for the past eight months and which was only partially relieved by bed rest. He recalled having lifted a heavy kettle twenty years ago whereupon he heard a cracking sound in his right hip and experienced excruciating pain. He was kept in bed in the hospital for the following six weeks and was ambulatory on crutches for six months afterward. The patient was unable to furnish any information regarding diagnosis or treatment during this period. One year later he contracted a gonorrheal infection and within several weeks his hip became stiff. He claimed that there had been no change in the deformity of the involved extremity during the intervening years.

The initial examination revealed the patient to be an obese, stocky male. He walked with a side-lurching gait. The right lower extremity had an apparent shortening of three inches, an actual shortening of one and one-half inches, and was held in 30 degrees of external rotation and 30 degrees of adduction. A 35 degree flexion contracture of the hip was present and further flexion to 60 degrees was possible. The circumference of the thigh 10 cm. above the patella was 6 cm. less on the involved side. The circumferences of the calves 10 cm. below the patella were the same.

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Roentgen examination on March 17, 1943, of the hip revealed the following: "The head of the femur is badly deformed. The bone around the joint is markedly and irregularly condensed and there are large sharp exostoses present at the joint margin. These changes seem to be due to an old healed inflammatory process. Chest—There is an old calcified primary lesion in the lower right lung field." The laboratory findings were as follows: Sedimentation rate, 42 mm. per hour (Westergren); tuberculin skin test positive; white blood count 12,600, neutrophiles 67 per cent; hemoglobin 103 per cent, red blood count 4.66 million; urinalysis negative; Wassermann test negative.

FIG. 3. FIG. 4.

FIG. 5. FIG. 6.

FIG. 3. Roentgenogram showing the amount of abduction at the pseudo-arthrosis.

FIG. 4. Roentgenogram showing the amount of adduction at the pseudo-arthrosis.

FIG. 5. Roentgenogram showing the amount of flexion at the pseudo-arthrosis.

FIG. 6. Roentgenogram showing the amount of extension at the pseudo-arthrosis.

Because of the marked deformity of the extremity and the apparent activity of the infectious process in the hip, an ischiofemoral arthrodesis was performed on April 17, 1943. An osteotomy was done below the level of the lesser trochanter and the adduction and external rotation deformity corrected. A massive bone graft consisting of anterior cortical surface of the tibia was removed and sharpened

at one end. Using two osteotomes, the ischium was then fractured and the graft guided into position. The wound was closed in layers and

Fig. 7. Roentgenograms showing neutral position.

the patient immobilized in a double spica cast.

Roentgen examination of the hip taken on December 20, 1943, seven months after arthrodesis, was reported as follows: "The bone graft remains in place and is intact. The amount of callus in the lateral femoral triangle between the distal femur and the graft has increased moderately in density. It is very difficult to say whether bony union between the proximal femur and the graft has occurred although it would be safe to assume union from the distal femur to the graft. The hip appears solidly fused."

A leather and steel single spica brace was worn at home until February 1, 1944. On that day, while at home and not wearing the brace, he fell and sustained a fracture of the right external femoral condyle without material displacement. A long leg cast was applied the same day.

Fluoroscopic and *x*-ray examination April 28, 1944, about two months after the above injury, demonstrated that there was relative motion between the distal portion of the femur and the bone graft on abduction and adduction of the distal femur.

The long leg cast was removed at the end of six weeks and was replaced with the brace. The patient did not complain of discomfort and

Fig. 8.

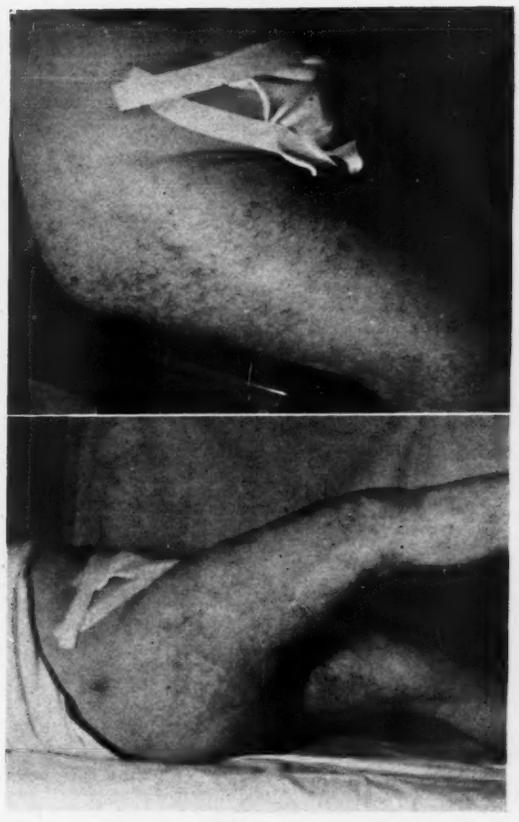

Fig. 9.

Fig. 8. Sitting position.
Fig. 9. Active flexion supine.

ten weeks after the fracture of the condyle began bearing weight on the right lower extremity. He was seen regularly in the outpatient department and showed progressive improvement except for a tendency toward external rotation of the extremity.

In September, 1944, seventeen months after the operation, the patient stated that he could walk a half mile without the use of a cane. Examination showed a 10 degree flexion contracture. He was able to flex his thigh to 55 degrees and to elevate and maintain the extremity against gravity.

When last seen in February, 1945, the patient was working as a bartender. He had no hip pain and could walk more than one-half mile without tiring. He was wearing a 1½ inch lift on the right shoe which brought the crests of the ilia to the same level. A moderate limp was noted. The extremity was held in 15 degrees eversion.

Fifteen degrees of flexion contracture was present. Further motion of the hip was abduction 20 degrees, adduction 20 degrees, flexion 60 degrees, external rotation 30 degrees.

FIG. 10. Active abduction supine.

FIG. 11. Active adduction supine.

COMMENT

The accepted operative treatment for the unsound hip is arthroplasty or arthrodesis. Arthroplasty will produce a movable but frequently a painful hip. This is borne out by Kellogg Speed's report, which records 60 per cent satisfactory results in 225 hip arthroplasties. He sets as a standard for a satisfactory joint a hip which has 40 degrees of flexion and 50 per cent of abduction and external rotation.

A fusion of the hip can be expected to result in a stable, painless joint. Melvin Henderson, however, points out that the American patient is loath to accept a stiff hip.

A method that will stabilize the hip, but at the same time allow a limited amount of motion would, therefore, have a definite place in the treatment of the diseased hip. This is especially true when the destructive process is still active in the hip joint. The case presented demonstrates this method. That this is not an isolated instance can be seen from the reports of Brittain, in whose series of thirty-five ischiofemoral arthrodesis three failed to fuse, but the patients had no complaints. The process through which this stability and mobility was produced, can be demonstrated by the numerous *x*-rays in this case. The tibial graft passed through the stages of aseptic necrosis and partial absorption, but still acted as a stabilizer so that early fusion took place between the head of the femur and the acetabulum.

To enhance the possibility of creating a fusion and a pseudoarthrosis about the graft, several suggestions are offered: (1) The use of a massive tibial graft with the medullary surface facing the proximal femoral fragment; (2) fixation of the tibial graft to the upper fragment with a screw; and (3) the use of traction while the patient is in the spica cast to create slight distraction at the osteotomy site.

SUMMARY

1. A case of infectious arthritis of the hip was presented in which an ischiofemoral arthrodesis was performed according to the technic of Brittain.

2. The unusual clinical result in this patient suggested another approach to the

operative treatment of the diseased hip, namely, an ischiofemoral arthrodesis of the proximal fragment by a massive tibial bone graft and a pseudoarthrosis between the tibial graft and the distal fragment.

3. Suggestions were offered for the formation of the pseudoarthrosis.

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Achondroplasia is a congenital abnormality of bone formation from cartilage, with resulting deficient growth in long bones; the subjects having long bodies, large heads, and short limbs (*achondroplastic dwarfs*).

From "Principles and Practice of Surgery" by W. Wayne Babcock (Lea and Febiger).

LEFT-SIDED APPENDICITIS IN A DEXTROCARDIAC PATIENT

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THE purpose of this paper is to report a case of acute left-sided appendicitis with dextrocardia, diagnosed by examination before operation. A brief review of the literature of this condition is also described.

FIG. 1. Left-sided appendicitis in a dextrocardiac patient.

In reviewing the literature on complete and partial visceral transposition we find that this condition is not a common one although it cannot be said to be rare. However, because this condition falls into an interesting group when surgical intervention is necessary and complicates the surgical problem involved, we believe that this condition is important enough to warrant reporting.

CASE REPORT

Case No. 8116, Revere General Hospital. E. G., a white male aged ten, was stricken with acute left-sided abdominal pain on March 12, 1944, three days before operation. Because of the fact that the pain was localized to the left of the abdomen, the child's parents did not seek medical advice. In the interim he was treated by enemas and purgatives at home. The pain was at no time referable to the right side. The pain increased and vomiting occurred. Fever developed on the second day. When seen at home by Dr. Miller on the third day of illness the child was acutely ill. His temperature was 101°F., pulse 110; respirations 30. The tongue was dry and features showed signs of dehydration. Examination of the chest revealed the heart to be on the right side, the cardiac impulse being in the fifth interspace on the right. Heart sounds were regular, rate 110, of good quality with no murmurs. The lungs were clear and resonant throughout. The abdomen was symmetrical, and moderately distended. The liver edge was felt in the upper left quadrant.

There was marked spasm and tenderness in the whole left lower quadrant. Rectal examination showed exquisite tenderness in the left lower quadrant. Routine blood examination revealed a white count of only 9,650, red blood count of 4,126,000 and a hemoglobin of 92 per cent. The urine examination was negative.

Because of the findings of an acute abdominal condition on the left side with a dextrocardia, a diagnosis of left-sided appendicitis in a case of situs viscerus inversum was made.

Operation was performed on March 15, 1944, at the Revere General Hospital. Under ether anesthesia a left low rectus muscle retracting incision was made. On opening the peritoneum free fluid poured forth. The cecum was found on the left side, revealing an acutely inflamed fibrinous covered appendix. This was removed in the usual manner and a double tie made about the stump. Sulfanilimide, 3 Gm., was sprinkled into the abdomen. The abdomen was sutured in layers with no drainage. The child made an uneventful recovery and was discharged on the tenth postoperative day.

The pathological report confirmed the findings of an acute, gangrenous appendix the lumen of which contained thick reddish pus.

INCIDENCE

A review of the incidence of partial or complete situs inversus viscerum reveals that this anomaly has been reported by many authors. In 1922, Sherk, of the Mayo Clinic, observed this condition ten times out of 347,000 admissions from 1910 to 1922. In a recent personal communication from Dr. Stuart Harrington from the Mayo Clinic, it was reported that out of 100 cases of transposition diagnosed there, approximately one-fourth received surgical treatment. Adams and Churchill state that situs inversus occurred in twenty-three cases out of 237,112 admissions to the Massachusetts General Hospital, Boston, Massachusetts. Various authors have reported that situs inversus vicerum rarely occurs alone and most always occurs with dextrocardia.

ETIOLOGY

As to the causes of left-sided appendicitis, Karewski divides the classification as follows: (1) Total transposition of the viscera; (2) primary solitary transposition of the cecum; (3) excessive length of the appendix which extends behind the bladder transversely through the pelvis, and (4) a normally located appendix but with mobile cecum with an adhesive type of appendicitis whereby the appendix is diverted to the left side.

EMBRYOLOGY

According to various investigators, the cecum up to the third month of intrauterine life, is located in the left iliac fossa. Rotation of the cecum now occurs and ascends to locate itself in the right iliac fossa. When the phenomenon is complete, the right colon crosses the duodenum in the upper abdomen and the ileum enters the cecum from the left side to the right. If failure or arresting of the process occurs at any point, this would determine the position of the appendix.

CONCLUSION

The presence of dextrocardia should lead the examiner to make a careful abdominal examination for the accompanying presence of visceral transposition.

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MASSIVE ENLARGEMENT OF THE PROSTATE

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MASSIVE enlargement of the prostate is uncommon if the sparsity of reported cases reflect the incidence of occurrence. The symptoms produced by prostatic hyperplasia are usually sufficient to warrant investigation and subsequent treatment long before the enlargement assumes enormous proportions. The symptom producing phenomena accompanying prostatic hypertrophy are not well understood. The factors governing the position, the direction and the extent of the hyperplasia are such that they are not applicable to all instances of prostatic enlargement.

Clinically, the size of the obstructing hyperplastic tissue rarely, if ever, bears any relation to the degree of symptoms produced. A small amount of obstructing tissue may produce marked urinary symptoms, even to complete urinary retention. In contrast, a massive hyperplasia may produce few symptoms and may be found only on routine examination.

The normal prostate weighs about 23 Gm. The average adenomatous enlargement varies from 35 to 75 Gm., seldom exceeding 85 Gm. A markedly enlarged prostate is usually considered to weigh under 200 Gm. Massive enlargement of the prostate has been infrequently reported. Freyer (1906) reported a case in which the prostate weighed 535 Gm. Douglass (1927) reported a gland weighing 680 Gm. White and Gaines (1936) reported a case in which the gland weighed 397 Gm. It may be readily seen, from the number of cases reported and the intervening years, that massive enlargement of the prostate is uncommon.

The case about to be reported is unusual not only because of the extent of the hyperplasia but also due to the fact that the symptoms, although long-continued, were relatively mild. The patient was aware of the existence of prostatic enlargement for twenty-five years and at no time, until the terminal illness, were the symptoms sufficient to cause the patient to consider surgical relief.

CASE REPORT

W. A. N., an eighty-eight year old white male, was referred by Doctor George Mark because of frequency of urination of two weeks' duration. The patient complained of pain and burning on urination of several days duration. He voided small amounts of urine at frequent intervals. He was markedly constipated. The patient gave a past history of usual health until twenty-five years ago, at which time he developed acute urinary retention following a long automobile ride. The retention was relieved by catheterization. Every six to twelve months following the first episode, he developed acute retention which would be relieved by a single catheterization. He concluded that as long as the acute retention occurred so infrequently and was so easily relieved, he would do nothing further about it.

On examination, a state of acute retention existed. The bladder could be readily palpated above the symphysis.

Rectal examination revealed an enormous enlargement of the prostate that quite completely filled the rectum. Only the lower edge of the enlargement could be palpated. The mass was so large and so high that the examining finger could not begin to palpate the prostate in its entirety.

A Robinson urethral catheter was readily introduced. The entire catheter, with the exception of the distal half-inch, was necessarily inserted before urine was withdrawn. As the catheter was being introduced, a flow of bloody mucopus gushed from the catheter. There was no urine evident in the expelled

material. The catheter was further advanced a distance of two inches into the bladder and clear but concentrated urine was withdrawn.

Fig. 1. The entire mass removed at autopsy included the prostate and bladder. The bladder may be seen to be pushed in front of the massive enlargement of the prostate. A distinct funnelling may be seen between the lateral lobes, which accounts for the relative ease of urination. A necrotic area may be noted at the inferior margin of the large lobes. This area is the opening of a sinus which extended posteriorly into a cavity approximately 5 cm. in diameter. The hyperplastic tissue measured 12 by 10 by 6 cm. The entire mass weighed 1,300 Gm.

The catheter was tied in and the bladder was slowly decompressed.

Following decompression of the bladder, a firm, rounded mass was distinctly palpable immediately above the symphysis. The nature of the mass was not ascertained until autopsy.

Due to the patient's greatly debilitated condition and the length to which the catheter was necessarily inserted to enter the bladder, cystoscopy was not attempted.

On admission, June 11, 1943, blood urea nitrogen determination was 17.4 mg. per 100 cc. The day prior to his death, July 2, 1943, the blood urea nitrogen was 25 mg. per 100 cc.

The report of the pathologist of the findings at autopsy is given verbatim:

"Peritoneal cavity:

"When the peritoneal cavity is opened, a large mass is found in the region of the bladder. This mass almost completely fills the pelvic cavity, causing compression of the sigmoid colon. The bowel appears to be normal in diameter. There is no evidence of peritonitis. Both liver and spleen are slightly enlarged but otherwise the peritoneal contents are normal.

"The Urogenital System:

"Both kidneys are considerably enlarged due to numerous large retention cysts. The left kidney weighs 240 grams, the right 560 grams. Cysts have thin, translucent walls and they are distended by considerable quantities of clear, amber colored fluid. There are two large cysts at the lower pole of the right kidney and one of these displaces the ureter and causes it to be flattened. However, there is no evidence of dilatation of the ureter proximal to this point and the pelves of both kidneys appear entirely normal. The kidney parenchyma of both kidneys is somewhat distorted by numerous retention cysts, but the kidney cortical tissue appears to be normal.

"The pelves and ureters are normal except as above described. The pubic bones are removed and the urethra, prostate, bladder and ureter are dissected out in toto. The distal portion of the ureters are normal in all respects. They empty without obstruction into a bladder of about normal size. The lining mucosa of the bladder shows no evidence of inflammation. The wall is not thickened. The bladder contains a small amount of grossly normal urine. The bladder is greatly elevated by a huge mass of tissue which is found to be the prostate. The entire mass is spheroid and when the urethra is dissected out, the mass is found to consist of two ovoid tumors each measuring 12 by 10 by 6 centimeters and the whole weighing 1300 grams. (Fig. 1.) The penile and prostatic urethra show gangrenous changes and at the level of the verumontanum there is an opening through the left posterior aspect of the urethra which leads into a cavity in the left prostatic mass. The opening measures approximately one centimeter in diameter. Its edges are ragged and necrotic and it leads into a cavity measuring approximately five centimeters in diameter and from this cavity a considerable quantity of extremely foul, clotted blood can be expressed. The capsules are not invaded and when sectioned they show what appears to be tumor tissue. The median lobe is not remarkedly enlarged."

CONCLUSIONS

A case of massive prostatic hypertrophy is presented. The total mass, which included the bladder, weighed 1,300 Gm.

The patient did not seriously complain of his symptoms until two weeks before admission to the hospital, although he had repeated but temporary attacks of acute urinary retention over a period of twenty-five years.

The finding of such an enormous gland substantiates the statement that clinically, the size of the hyperplastic tissue rarely, if ever, bears any relation to the degree of the symptoms produced.

ACUTE MESENTERIC OCCLUSION

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HOUSTON, TEXAS

ACUTE mesenteric occlusion is one of the most serious, acute, surgical conditions of the abdomen. The diagnosis is often very difficult and usually is not specifically made until after the abdomen is opened. One of the reasons that the diagnosis is not made is because of the rarity of the condition.

The incidence has been very variably reported, from .105 per cent by Laufman, and Scheinberg, to .041 per cent reported by Warren and Eberhard. Whittaker and Pemberton, in 1938, reported sixty proved cases from the Mayo Clinic and Laufman and Scheinberg reported forth four cases in 1942. Other sporadic cases have been reported, some successfully treated. Undoubtedly many of the unsuccessful cases never get into the literature. Warren and Eberhard present the following outline of the Etiology of Mesenteric Vascular Occlusion:

1. Known infection: Including thrombophlebitis, appendicitis, pelvic abscesses, peritonitis and general sepsis.

2. Hematogenous causation: Blood dyscrasia or changes known to predispose to thrombosis, such as splenic anemia and polycythemia vera.

3. Traumatic: Trauma of any sort to mesenteric vessels, tearing of mesentery and trauma from abdominal operations.

4. Mechanical: Largest group. Portal stasis, pressure from tumors, pressure from adhesions or congenital bands.

"Volvulus, strangulated hernias not included."

Laufman and Scheinberg have also reported two cases that followed operation of the lumbar sympathetic chain. Lumbar sympathectomy had been performed on one patient. One of the other cases followed injection of novocain. Bauer has also reported a case in which death occurred, due to superior mesenteric thrombosis following injection of the lumbar sympathetic chain for thrombosis of the femoral vein. Welsh and Mall, in experimental work on the dog, found that if more than 5 cm. of the small intestine is deprived of arterial blood supply the segment will undergo infarction and gangrene. If less than 5 cm. is involved, the circulation is preserved by blood entering through each end, by way of the intramural channels.

The symptomology is not always clear. The picture is usually that of an acute abdominal emergency. Acute intestinal obstruction is most often suspected. However, the pain is usually out of proportion to the physical findings. Shock is also usually pronounced. The important thing is to recognize that an acute, abdominal emergency exists and to proceed promptly with operation, for delay is one of the reasons for the published high mortality.

In the reported series, the diagnosis was made preoperatively in about one-fourth of the cases. Of course, many of the patients have other serious conditions such as heart disease, kidney disease, or liver disease, and often are moribund when the final catastrophe takes place. This is another reason why the mortality is so terrific. The published mortality has varied in the larger series of cases from 84 to 90 per cent.

The only treatment is prompt operation with resection, and resection should be carried out well beyond the area where there has been interference with circulation. In our reported case, five and a half feet of the intestine were removed. About

four and one-half feet of it was completely black, and about six inches on each side showed interference with circulation. Resection was carried well up into good intestine. The point which is very important is that thrombosis may continue in the partially devitalized area and gangrene actually occur in that area later. If one cannot be sure of the circulation in the end involved, it is better to close the end of the intestine and make a lateral anastomosis rather than do an end-to-end anastomosis.

CASE REPORT

The patient was a white male, age forty-two, a shipyard worker. In September, 1944, he had polyarthritis. A superficial phlebitis of the left leg was also present; it never became very extensive. In December, 1944, he was seen by his family physician and was found to have a good deal of evidence of kidney disease, as shown by albumen, casts and red blood cells in the urine. His arthritis at that time had pretty well subsided. The phletitis had completely subsided. He had some very badly infected teeth, and in January, 1945, two of these teeth were extracted and almost immediately he developed clinical signs of pneumonia, bilateral basilar type. He was extremely ill but finally, under sulfanilamide therapy, made a slow recovery. No *x*-ray was ever made because he was never hospitalized. He had gotten over his pneumonia and began to get around. There had been some complaint of intermittent abdominal pain, which was never characteristic; and although appendicitis and cholecystitis had been suspected, a true diagnosis could not be made because of the indeterminate nature of the symptoms. He seemed to be making a slow recovery and was getting around recovering strength and had been to his doctor's office on the morning of March 25th.

That afternoon he went to a movie and while he was at the movie he was suddenly seized with terrific abdominal pain. This occurred at 6:30 P.M. and he summoned his family doctor. A diagnosis of an acute abdominal emergency was made. It was suspected preoperatively that he had a small appendiceal abscess, which he had been walking around with, which had ruptured and caused a fulminating type of peritonitis. He was suffering extreme pain, was in moderate shock, had a generalized abdominal rigidity, his blood pressure was normal and his temperature was 101°F. His leucocyte count was 13,000. All of the possibilities of causing such a syndrone were mentioned, but no true diagnosis could be made. The most likely thing seemed to be in reference to his appendix. The abdomen was opened within two and a half hours after the onset of his symptoms and a gangrenous intestine, which actually measured five and one-half feet after it was removed, was found. The mesentery was thickened, rubbery, and gave the impression of a fairly long standing inflammatory process. Resection was carried out close to the bowel wall and sections of the mesentery revealed no evidence of tumor. An end-to-end anastomosis was made and the opening in the mesentery closed. Continuous Wangensteen suction was instituted. The patient was given intravenous fluid, 3,000 cc. a day. He was given 500 cc. of blood immediately after operation.

His condition remained satisfactory throughout. He had a very easy, almost uneventful convalescence. He had, at no time, become very distended and his general condition rapidly improved. He was allowed to be out of bed on his eighth day, and left the hospital on his fourteenth day after the operation, having been up walking around the ward for two or three days previously. His condition since that time has continued uninterruptedly. Two months after operation he was dismissed for work at the shipyard.

COMMENT

This patient undoubtedly had an acute arterial occlusion as judged by the very sudden onset of the symptoms, with the severity of the pain quite striking. The pain itself was quite shocking. We believe that the success of this case was due to the promptness with which the surgical attack was carried out. However, the mechanism whereby the process came about, certainly is not clear. It is thought that the embolus might have come from the pulmonary circulation following his recent bout of pneumonia. In fact, his clinical pneumonia may have actually been multiple infarctions of the lung. It is surprising how well he stood such an extensive surgical procedure at this time,

yet only just several months previously had had such a terrific time following extraction of only two teeth. One of the very interesting things in surgery is how the risk involved and the procedure varies from time to time, and also how the symptoms and pathology often do not parallel.

SUMMARY

A case of successful resection of sixty-six inches of the ileum for acute mesenteric occlusion is reported.

The prompt resection was the chief reason for success.

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Bookshelf Browsing

THE CLINIC OF LAWSON TAIT OF BIRMINGHAM IN 1884*

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YEARS ago, Elbert Hubbard wrote a number of "Little Journeys," some to the homes of great musicians, some to the homes of great poets, some to homes of the great and of the near great, but he neglected to write "Little Journeys" to the homes of great physicians.

To us physicians what could be more interesting than to study the lives of those other physicians who have found prominence, who have done good, who have served their country and who have taught as true physicians, their followers.

As we look through the lives of the great physicians of our country, we find some who have followed in the footsteps of illustrious Sires and who have carried the banner of public service as a family tradition and as a result of family upbringing. We find others who in spite of adversity, in spite of family handicaps, in spite of burdens of debt on young shoulders, in spite of discouragement have overcome every obstacle and reached a pinnacle in their chosen life work so high and outstanding in comparison with their early childhood as to outdo Alger in his wildest dreams. Such a one was George Ryerson Fowler. Born December 25, 1848, of humble parents, his public schooling stopped at a tender age, earning at the age of twelve, $3.00 a month, his food and the privilege of sleeping under the counter of a neighborhood store. He was a telegraph operator at night at the age of fifteen and a mechanic's helper in the day time, saving his money with the object of becoming a "doctor." This latter ambition had been implanted in his mind on seeing a fatal accident, a traumatic amputation of the leg with death from hemorrhage on the Long Island Railroad, fatal through lack of proper immediate treatment.

In 1884, George R. Fowler visited the clinics of Europe and I have been fortunate in receiving the diary of that visit on which this paper is founded. Among other clinics visited was that of Lawson Tait, then at the full height of his successful career.

Lawson Tait was by some thought to be the illegitimate son of Simpson. Simpson, according to one biographer, failed frequently like Henry Ward Beecher, to observe one of the Ten Commandments. On one occasion Tait was asked by his then assistant, McKay, whether there was any truth in this story. Tait leaned back in his chair, pushed his stomach out, pulled a lock of his hair over his forehead, and looking at McKay asked him what he thought. There certainly was a marked resemblance between Simpson and Tait. Tait had lived at Simpson's house and had been his student, and on Simpson's death Tait was given the papers and notes in regard to hospital mortality which was unfortunately cut short by Simpson's death. Simpson's son placed the papers in Tait's hands, but he did not find much that he could use. In fact, in studying the original returns from hospitals he is quite suspicious of either intentional or careless misstatement. Later on, Tait did make a study of hospital mortality which he

* Read before The Historical Section of the Medical Society of the County of Kings and the Academy of Medicine of Brooklyn, October 9, 1942.

published in 1877, dedicating the book to the memory of a great master, James Young Simpson, whose effort is dedicated by a grateful pupil. This study was the first made of the statistics of hospitals of Great Britain for fifteen years. Tait points out that the figures showed incontestibly that a more stringent inquiry is demanded as to the possibility of reducing the number of deaths in at least some institutions for the treatment of the sick poor.

Tait's life and work, his perseverence and skill, his honesty and fearlessness, his indomitability, his strength of mind and body, make him admired by surgeons.

He thought he could not teach, as witness his remarks about public clinics in his visit to Canada and the United States. Yet he did teach, and his teaching opened up to many the wide vistas of modern abdominal surgery.

Robert Lawson Tait (Edinborough 1845–1899) is better known as Lawson Tait of Birmingham where he settled in 1871. Here came to him patients from all over the continent and surgeons from all over the world. Tait argued against Listerism, denying that bacteria are pathological. He relied upon mechanical cleansing with soap and hot water, to which his marvelous success in ovariotomy was due.

In Greig Smith's* Abdominal Surgery, there are forty-five references to Tait, many more than to any other author, showing the diversity of his work and genius.

Though primarily a gynecologist, Tait was also a great general surgeon. To Lawson Tait belongs the credit of introducing and establishing the operation of hepatotomy. He had done this operation ten times when his work was published, nine times for hydatids and once for abscess. All were successful. Our own William Mayo's estimate of Tait was that he was the father of modern abdominal surgery.

As a gynecologist Tait played a great part in the development of the operative principles which had been established by McDowell, Sims, Emmett, and Battey in America, Koeberlé in France, Gustav Simon in Germany, and Sir Thomas Spencer Wells (1818–1897) in England. His success in operating was marvelous, so much so that at times his statistics were questioned but they were always proven true. His abdominal sections numbered by the thousands, with rarely a death. He never used any antiseptic precautions. The secret of his success was undoubtedly his rapid, skillful technic and cleanliness and the use of warm or boiled water to flush out the abdomen. He antedated Von Bergman in the development of what later became known as asepsis. He would allow no finger to the wound but his own so that although he did not acknowledge the causal relation of germs, yet he guarded against them. Tait performed the first successful operation for ruptured tubal pregnancy (January 17, 1883), was the first to work out the pathology and treatment of pelvic hematocele, and, in his "Lectures" on these subjects (1888),* he points out that the first authoritative treatise on extrauterine pregnancy was written by John S. Parry (1843–1876), of Philadelphia (1876). In 1879, Tait excised the normal ovaries,† along the lines laid down by Battey (1872–1873), but claimed that in none of his cases were the uterine appendages normal. This, with the similar operation of Alfred Hegar in 1877, developed, says Kelly, "the whole field of pelvic operations for diseases of the organs other than gross ovarian and fibroid tumors." "The peri-uterine phlegmons of Emmett and Thomas became recognized as tubal inflammations and abscesses." In 1879, Tait performed cholecystotomy, excision of hydrosalpinx and pyosalpinx, introduced his flap-splitting operation on the perineum, and his methods of dilating the cervix and of replacing the inverted

* Greig Smith, Vol. II, Page 979.

* Tait: Lectures on Ectopic Pregnancy and Pelvic Haematocele, Birmingham, 1888.

† *Brit. M. J.*, London, 1: 766, 1881.

uterus. In 1880, he introduced hepatotomy, and, in 1881, he devised the special operation for excision of the uterine appendages by securing the pedicle with a silk ligature, tied by means of his invention, the "Staffordshire knot." His method of "flapsplitting" in plastic repair of the perineum was a valuable innovation (1879), but it was not taken up in America for a long time. Tait left interesting summaries of conclusions from his operative statistics, treatises on diseases of the ovaries (1873) and diseases of women (1879–1889), and highly original essays on rape and other subjects connected with medical jurisprudence. In all these productions, he is a forcible, effective, frequently coarse, but always an amusing writer (Garrison).

Perhaps Tait's personality is best explained by quoting from the introductions to some of his books. One of the last, written in 1897, was at the request of McKay, who dedicated his book on perineal operations to "Amico Optimo, Praeceptori Sollertissimo, Lawson Tait."

"I have complied with the request of my friend Dr. Stewart McKay, to read the following pages and add a few notes, with much pleasure, because his description of my perineum operations are the first which I have seen full enough to be of any use to those desirous of doing these operations as I wish them to be done. This is probably to be attributed to a want of fullness or clearness in my own descriptions; a fault due to the fact that writing is to me an intolerable labour, and my attention has for years been closely occupied by matters which seemed to me more important. Besides, those who had seen me do the operations comprehended them so readily, carried their instruction away with them and reproduced it so perfectly, that the difficulty of understanding descriptions of them seemed to me only absurd.

"Yet, it must have been real, for I find my operations mixed up with those of other people in confusion most inextricable. I have seen a description of something called 'The Tait-Sänger operation' for which I desire to disclaim all responsibility, as with all similar mixtures. The difficulty of understanding alike my own description and some dozen others published in recent years appears at its height when Dr. Howard Kelly, in his article in Dr. Matthew Mann's 'System of Gynaecology,' considerately refrains from any allusion to the operations. Yet when seen and understood they are the simplest, neatest and most effective operations in surgery, have a fatality of certainly not more than one in five hundred, and their failures, in my own hands, are not over two in some thousands. Those failures were due to previous denudations.

"I think Dr. McKay's ingenious diagrams and carefully detailed description will bring the understanding of these simple proceedings within the reach of all."

Rarely does a preface disclose human characteristics so well, *appreciation* of McKay who was so long associated with him; *modesty* as to his own written teaching; *dislike* for writing; excellent clinical teaching; the ability to pass on technic to others; sarcasm as to Kelly's omission of the operation; and appreciation of his own ability and the excellence of his work.

Lawson Tait was so well thought of by his American colleagues that a résumé of his original work on extra-uterine pregnancy was read and lauded at a meeting of the American Association of Obstetricians and Gynecologists, held in Philadelphia, in 1888, as part of a symposium on extra-uterine pregnancy. Speaking at this meeting were Drs. Franklin Townsend, Joseph Price, E. E. Montgomery, W. H. Wathen, John B. Deaver, L. S. McMurtry and A. Vanderveer. Most of you undoubtedly remember Deaver, still many remember Vanderveer, and a very few McMurtry. All of you will recognize all the names as prominent ones in gynecology. I personally knew Deaver, McMurtry and Vanderveer, all good friends of G. R.'s. McMurtry and Vanderveer always visited our home when in New York.

The directness of the man is shown in the preface to "Diseases of Women," published in 1877, and dedicated "To Thomas Spencer Wells, in admiration of the brilliant work by which the art of surgery has been enabled materially to prolong human life." The preface written in 1877, reads in part as follows:

"Although Gynaecology has engaged the attention of many very able writers, it must be admitted that there is within its scope a great deal upon which our information is still far from being either complete or accurate. I must plead, therefore, that any new effort to extend our acquaintance with the special Diseases of Women deserves at least to be received with patience.

"Concerning some of these diseases I have ventured to advance new views, both of their pathology and their treatment, and towards these criticism may fairly be directed; but I can claim for most of them that they have already been published in the form of occasional papers, and have been well received by those whose opinions are of the greatest value.

"My chief object in this book has been to offer the results of my own experience in as condensed a form as possible; and I have therefore avoided, as far as I could, long quotations, needless reference, and detailed accounts of cases. I have also refrained from introducing illustrations of pathological appearances, for I have rarely found them to convey any very intelligible idea of the facts, unless in the form of costly lithographs; and the use of these would have greatly enhanced the cost of the book, without giving a corresponding increase to its value. The chapter on Diseases of the Ovary is an enlargement of my Hastings Essay of 1873."

Tait's humanity is further shown in his preface to his translation of the second German Edition of "Children's Diseases," by Steiner, in which Tait writes in October, 1874:

"I have added as an Appendix the 'Rules for Management of Infants' which have been issued by the staff of the Birmingham Sick Children's Hospital, because I think that they have set an example by freely distributing these rules amongst the poor for which they cannot be sufficiently commended, and which it would be wise for other sick children's hospitals to follow."

Tait's fairmindedness is shown in the preface to the 1883 (second) edition of "Diseases of the Ovaries" in which he writes in 1882, in part, as follows:

"I have found reason to change my opinion on some points, but they are of much less importance than I thought they would be when I first sat down to write these pages. I have seen far more reason for extending what I had to say; for the marvelous success which now attends the efforts of those who practice abdominal surgery has fallen largely to my lot, and therefore records of things accomplished, and opinions expressed upon them, will be found in these pages, which, eight years ago, were certainly beyond the limits of acceptance. Since then, however, great advances have been made, but much yet remains to be done, and all must rest upon the patience of the workers and the forbearance of their critics.

"For many imperfections of my book I have to offer the apology that I have but scant leisure for research, and fear I may not have done justice, in many instances, to the work of others. My writing is chiefly the outcome of my own experience, and of necessity is freely and unavoidably scattered with the pronoun of the first person."

He dedicated this work to Marion Sims, as follows: "Dear Dr. Marion Sims, I Dedicate THIS VOLUME TO YOU AS A TOKEN OF THE VALUE I PLACE UPON YOUR FRIENDSHIP, AND AS AN ACKNOWLEDGMENT THAT MUCH OF THE NEW WORK DESCRIBED IN IT IS THE OUTCOME OF YOUR INGENUITY. Yours Truly, LAWSON TAIT."

Tait's desire to give credit where due is shown in his contribution, CHOLECYSTOTOMY in which he writes:

"Dr. Marion Sims attributes to Dr. Handfield Jones and I think correctly, the merit of first suggesting that the liver and gall-bladder should be included within the field of surgical practice more fully than they had been up to that point, and particularly that surgical interference should be made in cases where death is threatened from the impaction of a gall-stone.

"To Dr. Marion Sims himself must be given the credit of having followed out this suggestion with his usual boldness and ability, and he himself points out that the case in which he did it was not successful only because the operation was too long delayed.

According to Greig Smith, the modern operation of cholecystotomy was first performed by Dr. Bobbs of Indianapolis in 1867, who incised the gallbladder, removed some fifty small calculi and closed the incision with one suture. His patient recovered. Marion Sims followed with an operation which, though unsuccessful, had a most important influence in advancing the surgery of the gallbladder. Sims originated the name cholecystotomy.

The preface to "Diseases of Women and Abdominal Surgery," 1889, Volume I, shows the way in which Tait's previous efforts had been received by some, and the spirit with which he met criticism. It is to be noted that his titles at that time were many, and including American titles as well. In the preface written in Birmingham, April 16, 1889, he says:

"In the preface to my first work of this kind, which appeared in 1877, I urged a 'plea that any new effort to extend our acquaintance with the Special Diseases of Women deserves at least to be received with patience.' This plea was, to a very large extent, disregarded, and the method in which my little effort was received was speedily manifested in two wholly different and, I am bound to state, wholly unexpected directions. The first direction to be indicated is, of course, the most extended, and that consisted of ridicule, abuse, and misrepresentation.

"The second direction was to me, however, far more important, and I soon ceased to trouble about the other. A small band of younger and more earnest men came to see and judge for themselves, and were speedily converted to the belief that a new field of work had appeared; and many who had started with a sneer at the 'Birmingham School of Gynaecology' remained to speak of it with respect, to adopt its methods, and become its earnest and progressive disciples.

"It is curious, as a mere little bit of history, to read the reviews of my work of 1877, and to read as a contrast the impression it has created in ten years as indicated in the pages of such a masterly work as Greig Smith's book on Abdominal Surgery, 1887.

"What I am now saying must of course appear as the outcome of egotism, but I must give it as the reason and explanation of much I have to include in the present work, and as a justification for my expressions of unbounded gratitude to the members of the American medical profession who have done so much to aid me in what has been accomplished. To many continental friends—Italian, French, Danish, and a few German—I have also a debt of acknowledgment to offer for their support and their candid acknowledgment of the value of what they have seen for themselves.

"During the period of these ten years Gynaecology and Abdominal Surgery have made marvelous advances. The old-fashioned school—the teaching of the speculum, the sound, the caustic stick, and the pessary—has been practically killed, and an advanced eclecticism now prevails. This has largely grown out of the wonderful revelations obtained by the experiences of operative surgery. In 1877, Spencer Wells left ovariotomy where it had been for half a century before him, with a mortality of

one in four. Now it has a death rate of a little more than three in a hundred, and this fact alone has given an impetus to and a facility for the alleviation of suffering in other directions, of the value of which the most enthusiastic estimates that have yet appeared, probably fall quite short.

"The present work professes to deal with 'Diseases of Women and Abdominal Surgery,' a title which records the historical fact that the evolution of abdominal surgery has proceeded entirely from the necessities of the special diseases of women, and their combination is now so complete that it is unlikely they will ever be again separated. The day has gone by when the treatment of pelvic and abdominal diseases, so prevalent amongst women and relatively so rare amongst men, was regarded as a mere appendix to the work of the accoucheur. It has gone as completely as the day when diseases of the eye were dealt with in a chapter appended to a text book on the practice of medicine. Gynaecology and obstetrics are now happily severed, and this division of labour has resulted in enormous advances for both.

"In the plan of the present book I have followed the scheme of my first publication. 'My chief object is to offer the results of my own experiences in as condensed a form as possible.' If the present edition is to have any value it can arise only from what I have to say of my own work. If I fail there I do not care to succeed by padding it with extracts from the work of others. Nor can I imagine it possible that any modern gynaecologist, whether he accepts my views or not, could conscientiously say that my work has not been extensive enough to entitle me to express my convictions concerning it."

To read this volume with the understanding of experience is indeed a treat. It is most extraordinary and wonderful in its teaching and refers to associated subjects in a charming manner. The man must have been both quite humorous, human and humane, as well as wonderfully balanced. He knew a great deal of medical history and had an enormous amount of common sense. He sometimes drove a point home in a manner which in those days was not considered dignified; for instance, Tait reproduces a picture of a tombstone and epitaphs and remarks speaking of repeated tapping of ovarian cysts.

"I found recorded on tombstones in the churchyards of Romsey, in Hampshire, and Bunhill Fields; and I leave the epitaphs to tell their own story, doubtless in these instances quite veracious.

In
Memory of
FANNY DAWKINS
who, after, five Years
soothing the Afflictions
of an aged MOTHER,
fell "asleep in JESUS,"
April 29th, 1826.
Aged 57 Years.

Also, MARY DAWKINS
Mother of the above
who having been tapped
for Dropsy 46 times
reposed in Christ, Sept. 1,
1826.
Aged 90 Years."

In Bunhill Fields is the monument of a courageous lady, whose memory is thus perpetuated. On one side of the tomb we read—

"Here Lyes Dame Mary Page,
Relict of Sir Gregory Page, Bart.
She Departed this Life March 11, 1728.
In the 56th Year of her Age.

And her fame rests on the inscription on the opposite side—

In 67 Months she was Tap'd 66 Times,
Had Taken away 240 Gallons of Water
Without ever Repining at her Case
Or ever Fearing the Operation."

I now quote from George R. Fowler's diary:

"Friday, May 16, 1884. Letter from Lawson Tait. In afternoon Kings College Hospital, no operations. To Meyer Meltzer Instrument makers. Bought 4 dozen needles and certified thermometer. 5:30 train to Birmingham, Queens Hotel.

"Saturday, May 17th. Called on Lawson Tait. The Crescent Private Hospital and residence adjoining houses. Saw him remove ovaries and Fallopion tubes for a small myoma. Operation about 25 minutes. Short incision, silk ligature of pedicle, silk sutures, complete closure of abdominal wound. No antiseptics. Instruments in water bath. Showed me about 24 cases of recent abdominal section, all doing well. In one case where hysterectomy had been done stump was suppurating freely as well as the abdominal wound. Stank. Dressed with dry lint.

"Afternoon—Stratford-on-Avon, tomb and birthplace of Shakespeare. Warwick and Castle via Charcote Park. Leamington to London by 6:00 o'clock train.

"Sunday, May 18th, Westminister Abbey Services. Sat under new bust of Longfellow.

"Afternoon—Dined with Mr. Messent at Peckham.

"Monday, May 19th. Birmingham on 2:30 train. Dined with Lawson Tait and afterwards accompanied him and his wife to the theatre.

"Tuesday, May 20th. Case of large myoma removed by hysterectomy at Birmingham Hospital for Women, by Mr. Tait. Operation lasting 35 minutes. Mr. Savage present, Pean's clamp and transverse pins to support the pedicle, peritoneal covering drawn over cut surface of stump and a few crystals of thymol placed under this covering so formed (Bontock's method, the thymol being Tait's idea). Dressed with absorbent cotton. To London 11:30."

It was during these visits to Tait that Doctor Fowler saw Tait operate for ruptured perineum and made the following notes:

"*Lawson Tait's operation for ruptured perineum as shown and demonstrated upon a patient by him for me*:

"First split up the remains of the perineal body upon the faces of its two halves to the full depth or thickness of its tissues, about midway between where the posterior commissure of the vulva should be, and the posterior limit of the rent, whether it, (the rent) includes the sphincter and rectal wall or not. Run this incision or 'split' up for an inch and a quarter or an inch and a half, upon either side. Then make an incision at right angles to each of these for about three quarters of an inch upwards, where their outer or nearest extremity joins the integument of the buttocks. A similar incision is made running downwards (patient on back) so that, upon the face of the rent upon either side there is a T shaped incision. Now dissect up the flaps so formed to a sufficient extent to get a good broad surface for union. This is all to be done with scissors. The upper triangular shaped flaps are turned upwards so as to close vaginal canal upon its floor, and the lower ones are turned downwards while the denuded surfaces from which they are reflected are brought together.

"The sutures: The first suture is the middle one. This commences where the *raw surfaces join the integument* and passes directly down to the bottom of the first incision. The second one is passed in like manner just above it and the third one below. This latter must come below level of sphincter, if the rupture is complete. These sutures should first, approximate the raw surface left by dissecting up the flaps, and second, the raw surface of the reflected flaps themselves. *In no case should a suture show either in vagina or rectum.* Now the upper angles of the flaps are joined by a superficial suture, and perhaps the lower angles likewise. Sutures Nos. 1, 2 and 3 of silver wire; superficial ones of silk. Bowels kept loose. Sponge in rectum during operation."

BIOGRAPHY OF JOHN HUNTER

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FEBRUARY 9th marks the birth of John Hunter of London, the father of experimental surgery. Because of the lack of knowledge of the average surgeon on historical matters, it seems appropriate to give a brief résumé of his life.

In the eighteenth century England was rapidly becoming the surgical capital of the world, and its most shining light was John Hunter (1728–1793). He ranks with Paré and Lister as one of the outstanding surgeons of all times.

Glancing at the London scene of 1748, we could have seen a short, thick-set, red-haired young man of twenty with a violent temper, freshly arrived from the Scottish provinces to seek his fortune. His name was John Hunter. The youngest of a brood of ten, he had lost his father when a boy, depriving him of any chance for an early education. He was in London to find employment or to enter the army. His older brother William, who had already established the first real medical school in London, took him on there in the dissecting room, trained him, and also opened for him opportunities to study under Cheselden and possibly also under Percival Pott, the most famous surgeons in England. Young John also attended Oxford, but hated it and left in less than two months, always referring contemptuously thereafter to the "stuffing with Latin and Greek."

After returning to his brother's establishment, in 1756 he obtained a post in St. George's Hospital similar to that of a modern house-surgeon. This hospital association was to last the rest of his life. As he threw himself enthusiastically into his work to make up for lost opportunities, his health suffered and in 1761 he had to become an army surgeon to get the change of climate he needed. In this capacity he spent two years abroad, part as surgeon in the hospital in Belleisle (against which the English had launched an expedition, in the endearing custom of those days), and part in Lisbon. In military surgery, like the great surgeons of all times, he received invaluable training. By his return he had recovered his health, gathered a mass of material for his treatise on gunshot wounds, and made the acquaintance of his future wife's family, the Homes. Hunter was never one to waste time.

Back in London, he lectured on practical anatomy and operative surgery, and took up his experiments on animals with his old enthusiasm. He even built a house to keep them in; he was, by the way, very fond of them, especially the fiercer ones, and took pleasure in wrestling with them.

In December, 1768, after many disappointments, he finally achieved the coveted appointment as surgeon to St. George's Hospital. For the next twenty-five years Hunter worked at a tremendous pace. His time was divided between his pupils and numerous apprentices, operating at St. George's, building up his museum, and his tireless researches in anatomy and pathology. He studied and described surgical shock, phlebitis (which he believed to be the cause of thrombosis, disproved by Virchow in 1852), pyemia, inflammatory processes, and the lymphatics. He discovered the lacrimal ducts in man, and was the first to differentiate between hard and soft chancre and to study the teeth scientifically.

An indefatigable worker, he usually got along on four hours' sleep a night, and the breadth of his interests produced researches, side by side, on the effects of smallpox on pregnancy and the plumage of hen-pheasants. These interests may seem unrelated to surgery, but actually

they were the essence of what John Hunter stood for in surgery and the groundwork of all his contributions—the application of the experimental method to surgery. Before Hunter Cheselden had raised surgery, particularly his specialty of lithotomy, to its highest skill. Hunter found surgery an art and left it a science. Anatomy, pretty well mastered by that time, was not enough, he taught; the surgeon must know physiology, the processes, causes and sequence of the morbid changes necessitating surgery. And these changes could be revealed by experiments on animals. For instance, his own operation for popliteal aneurysm was made possible because he had once tied off the main artery to one antler of a deer. Instead of the expected necrosis and gangrene, the blood supply continued to supply the antler through subsidiary arteries which enlarged and completely took over the function of the unused vessel. By other experiments Hunter had established the principle that coagulated blood was absorbed by the body provided no fresh blood was allowed to enter the chamber. On the basis of these discoveries on animals, he was enabled to tie off the popliteal artery well up the thigh, in healthy tissue, and let nature do the rest. He found the surgery of aneurysm in a primitive state and left it in a finished one. Before Hunter's time the old method of Antyllus had been used, namely, tying off the vessel above and below the aneurysm and then evacuating the sac. The mortality was so high that many surgeons of Hunter's time preferred Percival Pott's method of amputation above the tumor.

Hunter is believed to have been the first to give food and medicine through a stomach tube.

Hunter's insatiable curiosity led him to inoculate himself with pus from a gonorrheal patient, in which were also, unknown to him, the spirochaetes of syphilis. He watched and took careful notes on the course of the disease in himself, treating his lesions with mercury ointment. But eventually it centered in a generalized infection of the blood vessels, ascribed by many of his biographers to angina pectoris. This rendered him peculiarly susceptible to any undue physical or emotional stress, and eventually he was carried off by a fit of anger in an argument over the admission of some of his students to St. George's. Fittingly enough, he ended his career at the institution with which he had been so closely associated all these years.

This day in 1793 marked the end of a great and versatile surgeon, anatomist, and zoologist. From his pen had poured innumerable papers in both medicine and biology, among the best being the "Treatise on Venereal Diseases" for which he paid so dearly, "Observations on Certain Parts of the Animal Economy," and his crowning achievement, "Blood, Inflammation and Gunshot Wounds."

His influence was enormous also because he trained students in his experimental methods. His pupils, of whom Jenner was one, included all the great surgeons of the next generation, and they introduced his principles, dismissed as dreamy and theoretical by his contemporaries, everywhere they went in Europe and America.

He amassed and prepared, mostly with his own hands, a collection of 14,000 specimens, now in the possession of the Royal College of Surgeons of London. Thanks to him this museum ranks first in the world in comparative anatomy and zoology.

CORRESPONDENCE*

GLIMPSES OF VASCULAR SURGERY ON THE CORAL REEFS OF THE SOUTHWESTERN PACIFIC

At the time of this writing (during the fierce fighting at Okinawa, the Philippines and other battle fronts of the Pacific) every scrap of information that will tell of the experience, hardships and achievements of our heroic war-surgeons is interesting and informative.

This is particularly true of the war wounds of the blood vessels which, in many instances, still challenge our best efforts to save life and limb from their destructive effects, even when they involve only the peripheral arteries of the extremities. From this particular point of view, war wounds of the popliteal vessels are especially important. Their progressive increase in frequency and gravity has become one of the most conspicuous features of the two world wars. But in World War II destruction is far greater. All the missiles, implements, machines and methods of destruction by explosive shells, the fragmentation of bombs, torpedoes, buried ground mines, machine guns, hand grenades, etc., tremendously multiplied and perfected, are now directed to their human targets from the ground, the sky and the sea, thereby increasing the mortality of the central or visceral wounds and the crippling effect of the peripheral wounds of the extremities. Wounds of the popliteal vessels have the most disastrous effects on the lower limbs and the increase in the number of amputations caused by the popliteal injuries has been noted all along the North African, Italian, French and German campaigns. The evidence accumulated in the battles of the Pacific show that while there has been great improvement in life saving (by blood transfusion, especially) the popliteal wounds still remain a grave liability.

It is from this special viewpoint that observations contributed by Commander Holman are pertinent and important as they bear the stamp of his great competence and authority:

January 20, 1945. "On this 2 × 4 coral island in the Western Pacific, where we have been establishing a 1000-bed base hospital. First housed in tents, we have just moved into more comfortable Quonset huts, whose wooden floors are very welcome after four months on the sand and coral. It seems ages ago that we landed here, and the memories of those early hectic days are fast receding into the limbo of the past: the torrential rains with only pup tents for cover, the rivers of mud called roads, the jungle swamp chosen for our temporary camp site with its all-pervading odor of decaying Japs (and Marines), with its denuded skeletons protruding from mudsoaked uniforms, the ear-splitting roar of nearby howitzers and mortars, the whistling shells, and the zing of bullets that made one duck one's head involuntarily, raising it again, sheepishly, when one realized that nothing had happened (that time!).

"On arrival here on D-12 we were temporarily assigned to help the overworked surgeons of the Marine medical companies; we received our wounded direct from the battlefield not more than 800 yards away but from which we were protected by a ridge. The battlefield consisted of ridges with intervening valleys and innumerable caves—to oust the Japs from such terrain took many lives, many casualties and months of fighting!

* Extracts from letters addressed by Commander Emile Holman, Head of the Department of Surgery, Stanford University, and Chief Surgeon at Lane-Stanford Hospital, San Francisco, to Dr. Rudolph Matas, New Orleans, La.

"Some interesting *blood vessel injuries* have been encountered, not only here, but while stationed at Vella la Vella during the Bougainville campaign, and while on the U.S.S. Tryon during the Saipan-Tinian strike. As usual, injuries to the *popliteal vessels* proved most dangerous to life and limb. Of eight wounds of the popliteal space, six were followed by amputation and 1 of these died from ascending gas gangrene. Two died of g. gangrene without operation.

"Major J. M. Parker of the Army wrote me last May that in twenty cases only three limbs survived popliteal ligation. One of the invariable accompaniments of popliteal artery injury was the early development of an extensive, firm edema of the calf muscles which then rapidly became indurated, presenting a structural alteration that was hard and unyielding and which undoubtedly prevented the opening up of an effective collateral circulation. In two instances we split the skin and fascia longitudinally from popliteal space to ankle. The tight skin spread apart remarkably but it failed in its purpose—gangrene developed as usual. In one instance, I attempted an anastomosis without heparin—and it failed.

"In another instance ligation of both anterior and posterior tibial arteries—leaving only the peroneal—was *not* followed by gangrene.

February 26, 1945. "We have had no experience with Blakemore's tubes—nor are any available here, but in order to be prepared for the emergency, I have written for some. Heparin has also been lacking in the field.

"Last November during the Bougainville campaign I attempted *a popliteal repair* on a twenty-four-hour old injury with incipient dry gangrene of the toes hoping to limit the gangrene and enable us to do a below-the-knee amputation. At the time of operation there was no evidence of gas gangrene, and smears taken at the time were negative—so we repaired the vessel. Forty-eight hours later a cast applied to keep the knee in flexion was removed because of fever, and the thigh showed extensive infiltration with gas—amputation was performed—followed by death! It is such experiences in the field that make one reluctant to do much blood vessel repair: better a live patient with no leg than a repaired vessel and death!

"We have tried *refrigeration* in five patients—carefully noting the level of impaired circulation before refrigeration. In none was there any *extension* of the impaired area, but also there was no improvement nor evidence of revascularization of the impaired area, so that amputation was necessary at the same level indicated even before refrigeration.

"An interesting experience with *lumbar sympathetic interruption* makes us a little reluctant to use it routinely. We had been using it in all cases—but again were forced to the conclusion that in no instance had it saved a limb from amputation—nor had it improved the level necessary for amputation. This coincides with the experiences of Major J. M. Parker on the French front. In the case above mentioned, an extensive soft tissue wound of the left thigh with complete division of the *deep* femoral vessels and their branches produced a cold, blotchy, anesthetic foot. The patient was almost exsanguinated but after 2500 cc. of whole blood his blood pressure was restored from 50/? to 104/60. The foot, however, remained cold, blotchy and without feeling. Our neurosurgeon, well versed in lumbar sympathetic block, injected the lumbar sympathetics in the usual manner with novocaine—followed immediately by a general collapse with drop in blood pressure to 68/?. The thigh itself felt warmer (subjectively) and sweating of the involved limb was inhibited, but there was no improvement in the appearance of the foot. It occurred to us that such an untoward result (lowered blood pressure) might conceivably lead to thrombosis of small important collateral vessels—and therefore be harmful rather

than helpful. The collapse was short-lived, fortunately, and after 1500 cc. more blood, the posterior tibial pulse could again be felt, the foot lost its pre-gangrenous appearance, and the patient recovered without amputation. It is interesting that 4000 cc. of blood was necessary to restore his circulation to normal—an observation repeatedly made in the field. Many of the early deaths on the battlefield and at the field hospital are due to exsanguination and only whole blood will prevent death—not only of the individual but of a limb deprived of its main blood supply. *Restoration of blood volume is absolutely essential in the presence of an ischemic limb if it is to be saved.*

"Since Nov. 21, 1944, the Navy has been flying universal type "o" blood from San Francisco whence it is distributed in almost unlimited quantities to any outfit in the Pacific Area. Up to about ten days ago 86,000 pints of blood had been delivered in this area! And I am sure we are now saving some lives and limbs that were formerly lost. The blood is shipped in specially iced containers—kept at 40°F.—and is good for twenty-one to twenty-five days. Blood in the next war will be as plentiful as plasma in this war!

"But God willing—there won't be any next war! It is impossible to conceive, but exhilarating to think about, what 100 years of peace could do to wipe out poverty, illiteracy—and the diseases due to deprivation and ignorance. The awful waste of war must be seen to be appreciated: the sacrifice of handsome, able youths in their prime—and it's always the best that die; the mangling of perfect bodies, the ill usage and mal-usage of talent and ability, the horrible destructiveness of war's machines, the terrible waste of Nature's resources (man's priceless heritage) for purposes of destruction rather than construction, the waste of vast projects abandoned after huge expense of time, effort, and money—not to mention the incalculable demoralizing effect of the savagery—and the boredom—of war on all ranks and all services. There are brief—very brief moments of great heroic courage and great selfless service, but most aspects of war are sordid, and savage, and horrid, smeared with blood and dirt and filth!

"And the end out here is far from sight—as Iwo Jima well illustrates:—the going gets tougher and rougher as we approach Japan. But progress is being made—and ultimate victory is inevitable! Five months ago we were the front—now the front has moved forward 1000 and 2000 miles in this vast expanse of the Pacific! And I wish I were at Iwo Jima taking care of the Marines who are falling there as they fall here."

COMMENTARY BY DR. RUDOLPH MATAS

One fact appears to rise out of Dr. Holman's experience, namely, that a temporary lumbar sympathetic block by novocainization alone, appears to give no certain protection against gangrene of the leg in destructive popliteal injuries in which the collateral branches as well as the main artery are damaged. The greatest hope lies in the restoration of the volume and tension of the arterial supply through any collaterals that may have escaped the catastrophe. In the meantime, all methods and technics that aim at the restoration of the circulation directly through its main channels should be encouraged and cultivated so that a proper appraisement of their actual clinical value in the emergencies of warfare should be definitely determined. Some success was obtained by the French in the first world war by the use of Tuffier's vaselined silver tubes and remarkable success was claimed by the Germans for end-to-end arteriorrhaphy with the Carrel suture and by bridging over arterial gaps with autogenous venous grafts (Carrel, Guthrie, Lexer, Payr); and now the opportunity has come for testing the most promising American contribution to vascular anastomosis, namely, the simplified sutureless venous-lined vitallium tubes of Blakemore and associates, which

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Addendum. November 26, 1945: Dr. Holman's letters were written in January and February, 1944. Since that time, the Blakemore tubes have been sent to several battle fronts, but the opportunities for their favorable application appear to have been relatively few; at least, reports of their actual applications in the field, are not sufficiently available to this writer to permit of definite conclusions.

RUDOLPH MATAS, M.D.

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3. "Significance of the Nitrogen Loss in the Exudate from Surface Burns" by John W. Hirshfeld, M.D., Harold H. Williams, Ph.D., William E. Abbott, M.D., Carl G. Heller, M.C., Ph.D., and Matthew A. Pilling, M.D., in *Surgery*, XV, 5 (May, 1944), pp. 766-773.

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5. "New Type Plasma Filter Will Aid in Prevention of Fatal Wound Shock" in *Surgical Business*, V, 5 (May, 1942), pp. 20-21.

6. "Rayable Gauze as a Factor of Safety in Surgical Operations" by Edward F. Lewison, M.D., in *Bulletin of the American College of Surgeons*, XXVII, 1 (January, 1942), pp. 39-40.

7. "The Effects of Fiberglas on Animal and Human Skin" by Marion B. Sulzberger, M.D., and Rudolf L. Baer, M.D., in *Industrial Medicine*, XI, 10 (October 1942), pp. 482-484.

8. "Fiberglas Health Hazard Investigation" by Walter J. Siebert, M.D., in *Industrial Medicine.*

9. "Hazards of Exposure to Glass Wool, Glass Frit or Foam-Glass" by B. J. Hein, M.D., in *Journal of the American Medical Association*, CXXIV, 3 (January 15, 1944), pp. 187-188.

10. *Report of the Director of The Trudeau Foundation*—1941 by LeRoy U. Gardner, M.D., last page, describing findings based on inhalation tests in which animals were exposed to glass fiber dust.

11. *Health Aspects of Fiberglas Materials*, 8-page brochure, published in April 1945, for plant physicians, industrial hygienists, safety engineers, and others interested in a documented summation of facts relating to the subject.

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14. "Use of Fibrous Glass by the Army and Navy", by Major Hubert D. Keiser, A.U.S., in *Mining Technology*, VII, 3 (May 1943), pp. 1-14. Contains a comprehensive description of manufacturing processes.

15. "Fibrous Glass Insulation: Health Aspects of", joint memorandum (December 30, 1942) of the Bureau of Ships and the Bureau of Medicine and Surgery (BUMED FS/838-1 (103)).

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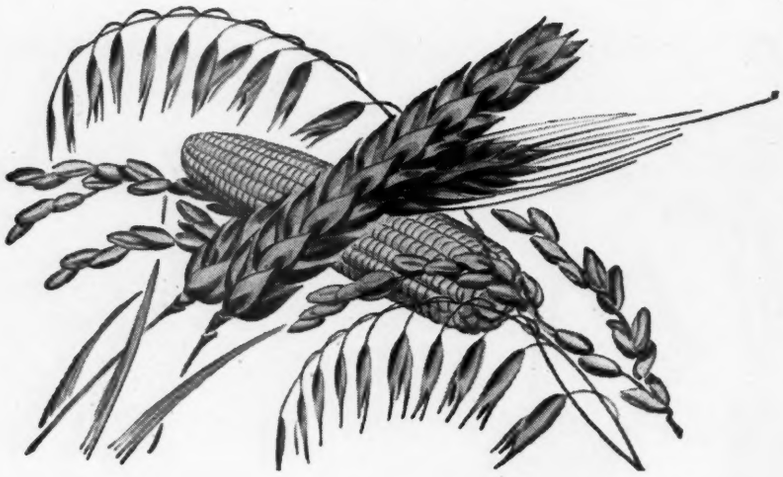

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"Back in '46—that was right after the war and sometimes the going wasn't too easy—I needed cash. Taxes were tough, and then Ellen got sick. Like almost everybody else, I was buying Bonds through the Payroll Plan—and I figured on cashing some of them in. But sick as she was, it was Ellen who talked me out of it.

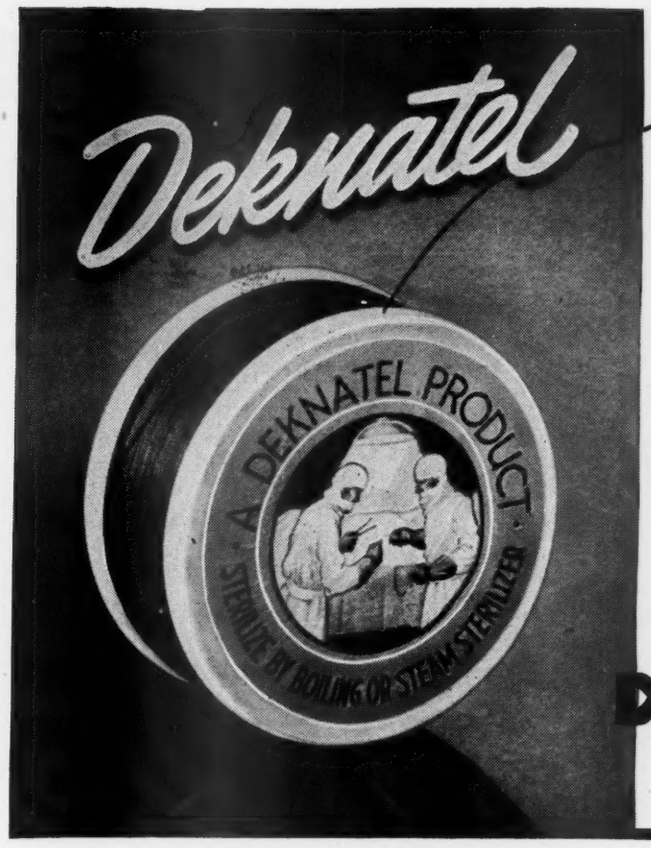
" 'Don't do it, John!' she said. '*Please* don't! For the first time in our lives, we're really saving money. It's *wonderful* to know that every single payday we have *more* money put aside! John, if we can only keep up this saving, think what it can mean! Maybe someday you won't have to work. Maybe we can own a home. And oh, how good it would feel to know that we need never worry about money when we're old!'

"Well, even after she got better, I stayed away from the weekly poker game—quit dropping a little cash at the hot spots now and then—gave up some of the things a man feels he has a right to. We didn't have as much fun for a while but we paid our taxes and the doctor and—we didn't touch the Bonds.

"What's more, we kept right on putting our extra cash into U. S. Savings Bonds. And the pay-off is making the world a pretty swell place today!"

The Treasury Department acknowledges with appreciation
★ *the publication of this advertisement by* ★

THE AMERICAN JOURNAL OF SURGERY



Surgical Sutures

SILK & NYLON

Moisture and Serum Resistant

Smooth, uniform, pliable suturing materials, braided and treated with meticulous care. Extra strong. Easy to work. Non-capillary, non-irritating, and non-culture mediums. Wide range of sizes, black and white, U.S.P. Resterilizable. Sold by Surgical-Hospital Supply Houses.

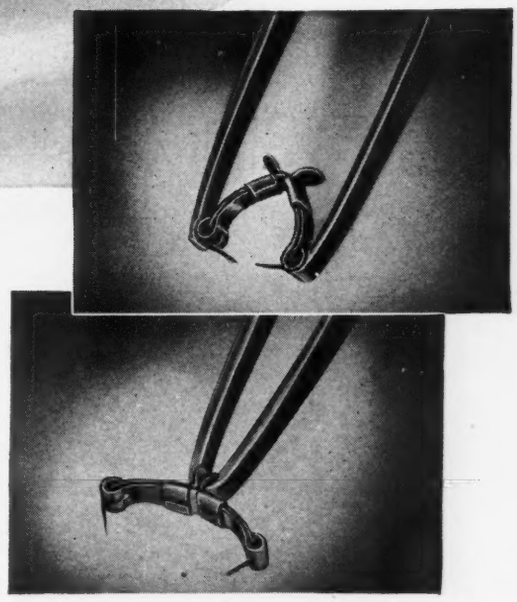
Deknatel is the Original Manufacturer of Braided and Treated Silk and Nylon Sutures.

DEKNATEL

Queens Village 8, (L. I.) New York

PROTECT GRANULATION TISSUE . . .

SERATURE WOUND CLIPS



offer widely recognized advantages in skin coaptation. These superior wound clips may be easily and quickly removed from the wound by simply compressing the integral spurs with an ordinary forceps or hemostat. Upon withdrawal, the arc described by the perfectly aligned teeth is identical to that of insertion. This exclusive Serature feature tends to reduce pain . . . minimizes the possibility of tissue damage . . . facilitates the clinical procedure.

MOST ECONOMICAL

Serature "spur" Wound Clips may be used repeatedly . . . a distinctive highlight from the standpoint of economy. Made of finest non-corrosive nickel silver, they may be sterilized by boiling, autoclave or by immersion in an efficient sterilizing solution. Available in 12, 14, 16, 18 mm. sizes.

Your dealer can supply you

PROPPER MANUFACTURING COMPANY

10–34 44th Drive Long Island City 1. N. Y.

This, too, is Preventive Medicine

For a large segment of our population this postwar adjustment period may present economic difficulties. In many such instances the first step toward "cutting down" will be to reduce food expenditures.

The advice to maintain nutrition, especially protein nutrition, may well be classed as sound preventive medicine.

Without sufficient protein intake—sufficient in quality as well as quantity—many phases of metabolic and functional life are bound to deteriorate.

An adequate amount of meat in the daily diet will go far in maintaining protein nutrition.

The Seal of Acceptance denotes that the nutritional statements made in this advertisement are acceptable to the Council on Foods and Nutrition of the American Medical Association.

AMERICAN MEAT INSTITUTE

MAIN OFFICE, CHICAGO . . . MEMBERS THROUGHOUT THE UNITED STATES

IODINE . . . A PREFERRED ANTISEPTIC

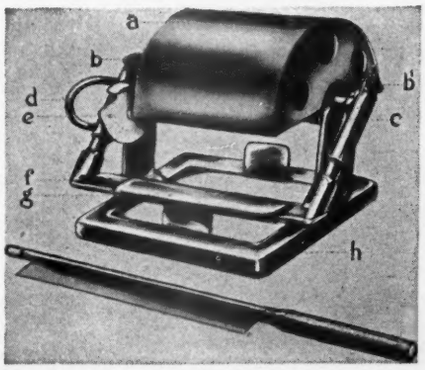
Quick and Lasting . . .

Reliance which the Profession has placed on Iodine for so many years is a tribute to its efficiency.
In preoperative skin disinfection, as an antiseptic for use in the office and on calls, Iodine provides quick bactericidal efficiency and lasting effectiveness.

★ **IODINE** *Foe of Infection* ★

Iodine Educational Bureau, Inc. 120 Broadway, New York 5, N. Y.

PADGETT-HOOD DERMATOME

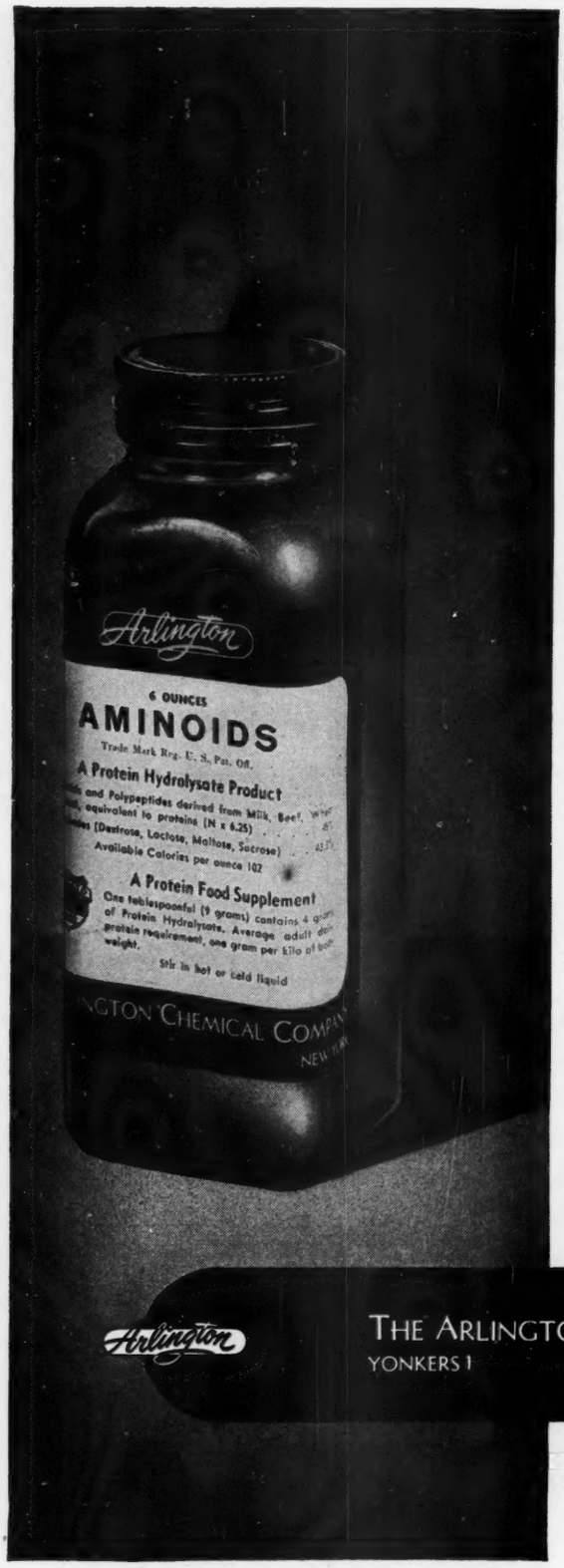


By means of this unique instrument a sheet of skin of uniform thickness may be cut at any predetermined level the size of the drum (4 x 8 inches) from any area of the body. Those who have used the dermatome state that it simplifies the technique and enlarges considerably the whole field of skin grafting. Same blade used for drum may be placed in handle and used to cut razor grafts or for honing blade. Rubber cement for the drum and donor area also is available, as well as a knife sharpening service.

Manufactured and sold by

The Kansas City Assemblage Company

609 EAST 17th ST., KANSAS CITY 8, MO.



Palatable

PROTEIN HYDROLYSATE

When protein supplementation is necessary, palatability of the therapeutic agent is an important factor.

The palatability[1] of AMINOIDS* has been demonstrated by ample clinical use. AMINOIDS blends tastefully with hot or cold liquids, and with numerous light foods, adding a distinctive flavor to puddings, custards, cereals, etc.** Palatability, plus avoidance of monotony, promote continued acceptance by the patient.

AMINOIDS, a protein hydrolysate product prepared by enzymatic digestion of beef, wheat, milk and yeast, contains the amino acids known to be present in these four high quality foods. AMINOIDS is readily absorbed from the digestive tract.

SUPPLIED: In granular form, in bottles containing 6 oz. One tablespoonful t.i.d. provides approximately 12 grams of protein as hydrolysate.

Aminoids

REG. U. S. PAT. OFF.

A PROTEIN HYDROLYSATE PRODUCT

For Oral Administration

ACCEPTED AMERICAN MEDICAL ASSN.

Arlington

THE ARLINGTON CHEMICAL COMPANY

YONKERS 1 NEW YORK

*The word AMINOIDS is a registered trademark of The Arlington Chemical Company.

1. Wilensky, A. O.; Surg. Gynec. Obst. 80:323 (Internat. Abst. Surg.) May, 1945.

**Recipe pads available on request.

Hypochromic anemia, by impairing the oxygen-carrying power of the blood, may exert its deleterious influence on every organ of the body. Although hemoglobin depression is often too slight to appear of clinical significance, the end result is frequently a syndrome comprising generalized vague, non-pathognomonic symptoms. The frequently associated anorexia and consequent inadequate food intake, together with impaired digestion, all tend to initiate or accentuate multiple nutritional deficiencies.

Heptuna supplies ferrous sulfate, the most readily available form of iron for hemoglobin synthesis, together with seven essential vitamins and fortified with the B-complex vitamins found in liver and yeast. This combination makes for maximal absorption and utilization of iron, stimulates hemoglobin regeneration, and effectively corrects many of the generalized, systemic disturbances encountered in hypochromic anemia.

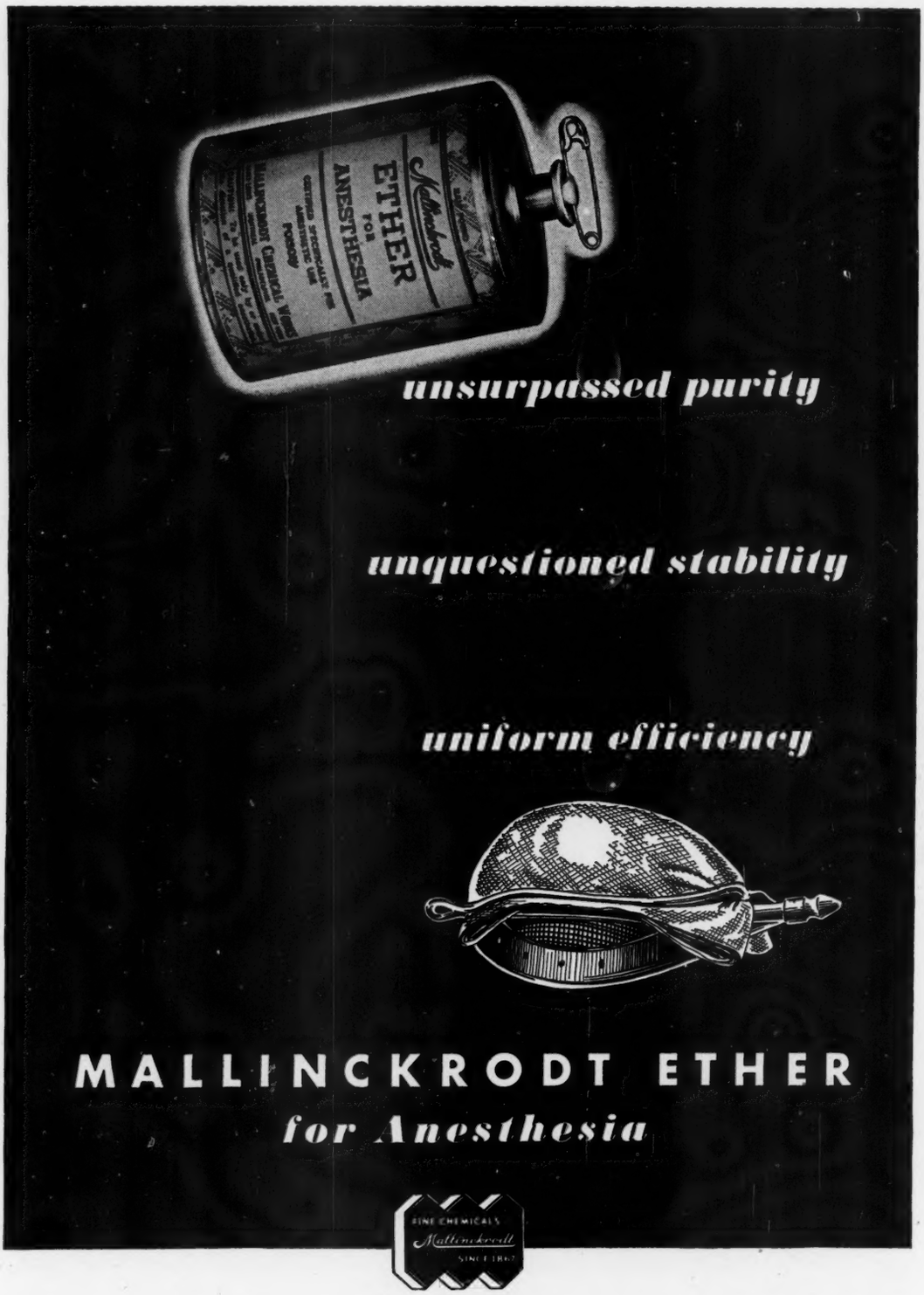
J. B. ROERIG & COMPANY • 536 Lake Shore Drive • Chicago 11, Illinois

Each Capsule Contains:	
Ferrous Sulfate U.S.P.	4½ Grains
Vitamin A (Fish-Liver Oil)	5,000 U.S.P. Units
Vitamin D (Tuna-Liver Oil)	500 U.S.P. Units
Vitamin B_1 (Thiamine Hydrochloride)	2 mg.
Vitamin B_2 (Riboflavin)	2 mg.
Vitamin B_6 (Pyridoxine Hydrochloride)	0.1 mg.
Calcium Pantothenate	0.333 mg.
Niacinamide	10 mg.

Together with a Liver Concentrate (Vitamin fraction) derived from 6.5 Gm. fresh liver and dried yeast U.S.P. Not intended for use in the treatment of pernicious anemia.

Heptuna

a **ROERIG** *Preparation*



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Safeguard

AGAINST

PRE and POSTOPERATIVE

IRON-DEFICIENCY

ANEMIA

100 CAPSULES
COPPERIN "A"
(for adults)
COPPER 1 MG.
IRON 32 MG.
IN AN ACTIVE SOLUBLE FORM
DOSE—One capsule three times daily after meals. Contents of capsule may be dissolved in milk, water or any formula, if desired
MYRON L. WALKER CO. Inc.
Mount Vernon, N. Y.

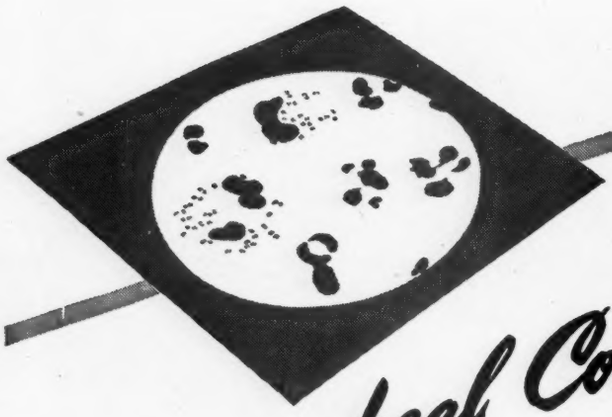
Iron-deficiency anemia is a factor to be considered in pre and postoperative conditions. Hence, we suggest that you prescribe Copperin routinely for a period preceding and following surgery. Copperin stimulates the hematopoietic system—provides material for replacement of hemoglobin—increases the red blood cell count.

Because in Copperin iron ammonium citrate is combined with the catalyst copper sulphate, there is a greater utilization of the iron by the system. For this reason the iron content per capsule is purposely small—32 Mgm. As there is no stomach irritation or constipating effect from Copperin, it is exceptionally well adapted to routine use. In two strengths: Copperin "A" for adults; Copperin "B" for children.

Liberal professional samples gladly sent on request

MYRON L. WALKER COMPANY, Inc.

Mount Vernon **New York**



In Gonorrheal Complications

IN THE FEMALE

MANY investigations and extensive clinical experience have shown penicillin to be the therapeuticum of choice in gonorrhea of the female and in the many gonorrheal complications—adnexal involvement, peritonitis, arthritis, gonorrhea during pregnancy and in vulvovaginitis of children. Penicillin produces rapid and consistently effective results even in patients who did not respond to sulfonamides.

Sweet, L. K., and Putnam, L. E.: The Treatment of Gonococcal Vaginitis in Children with Penicillin, M. Ann. District of Columbia 14:148 (April) 1945.

Gray, L. A.: The Treatment of Acute Gonococcal Pelvic Inflammatory Disease in the Female with Penicillin, Southern M. J. 38:405 (June) 1945.

Cohn, A.; Taylor, H. C., Jr., and Grunstein, I.: Penicillin Treatment of Sulfonamide-Resistant Gonococcal Infections in the Female, Am. J. Obst. and Gynec. 49:657 (May) 1945.

Sako, W.; Tilbury, R., and Colley, J.: One Dose Penicillin Treatment of Chronic Gonorrheal Vaginitis in Children, J.A.M.A. 128:508 (June 16) 1945.

Free, A. H.; Huffman, L. F.; Trattner, H. R., and Brown, H. B.: Oral Penicillin in the Treatment of Gonorrhea, J. Lab. and Clin. Med. 30:738 (Sept.) 1945.

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Chadwick, W. L.: Office Procedure—Penicillin Treatment for Gonorrhea in Four Hours—Male or Female, Rocky Mountain M.J., 42:851 (Nov.) 1945.

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Garvin, C. H.: Methods of Administration of Penicillin, Adaptable to Office Treatment of Gonococcal Infections, J. Nat. M.A., 37:180 (Nov.) 1945.

PENICILLIN - C. S. C.

Penicillin-C.S.C. is prepared under rigid laboratory controls which safeguard its potency, sterility, nontoxicity, and freedom from fever-producing pyrogens. The high degree of purification of Penicillin-C.S.C. minimizes the occurrence of untoward reactions.

ACCEPTED AMERICAN MEDICAL ASSN.

Penicillin-C.S.C. is accepted by the Council on Pharmacy and Chemistry of the American Medical Association

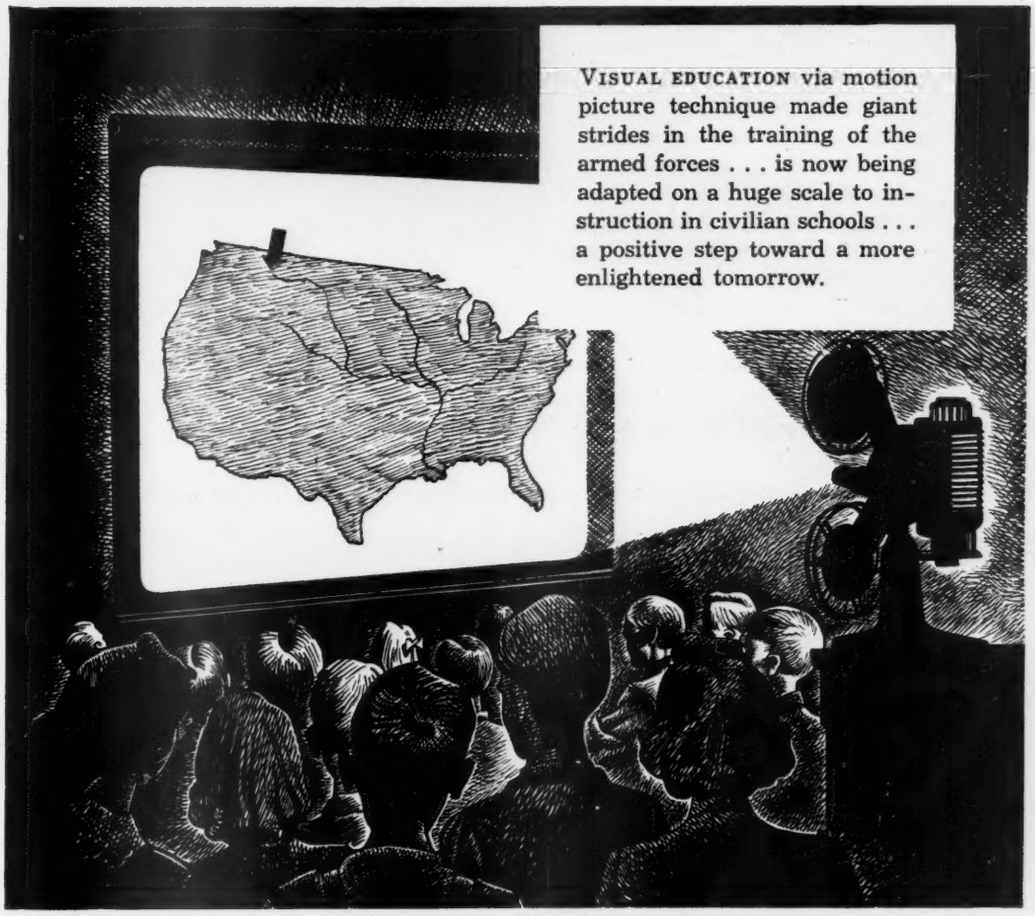
PHARMACEUTICAL DIVISION

CSC

COMMERCIAL SOLVENTS CORPORATION

17 East 42nd Street, New York 17, N.Y.

Toward a Better World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ANOTHER STEP toward enlightenment and social betterment of tomorrow's world: Lanteen Medical Laboratories present Lanteen products—leaders in their field—a glowing example of forward thinking—produced under the most rigid medical standards.

Since patients are not mechanically minded, simplicity and ease of handling are prime requisites for continued use. Lanteen Flat Spring Diaphragm is extremely simple to place—it is collapsible in one plane only. No inserter required. Distributed ethically—advertised only to the medical profession—available only upon the recommendation or prescription of a physician. Complete information upon request.

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with Trushay

Before examining and treating patients, every member of the profession wants his hands to be as hygienically clean as a good scrubbing with soap and water can make them.

But when you wash your hands and then use a hand lotion to prevent drying or chapping, some of the hygienic value of soap and water cleansing undoubtedly is lost.

TRUSHAY was specially formulated to be smoothed on BEFORE washing the hands, and thus serves a double purpose.

FIRST—**TRUSHAY helps prevent depletion of the skin's natural lubricant... aids in keeping the dermal tissue normal and unbroken.**

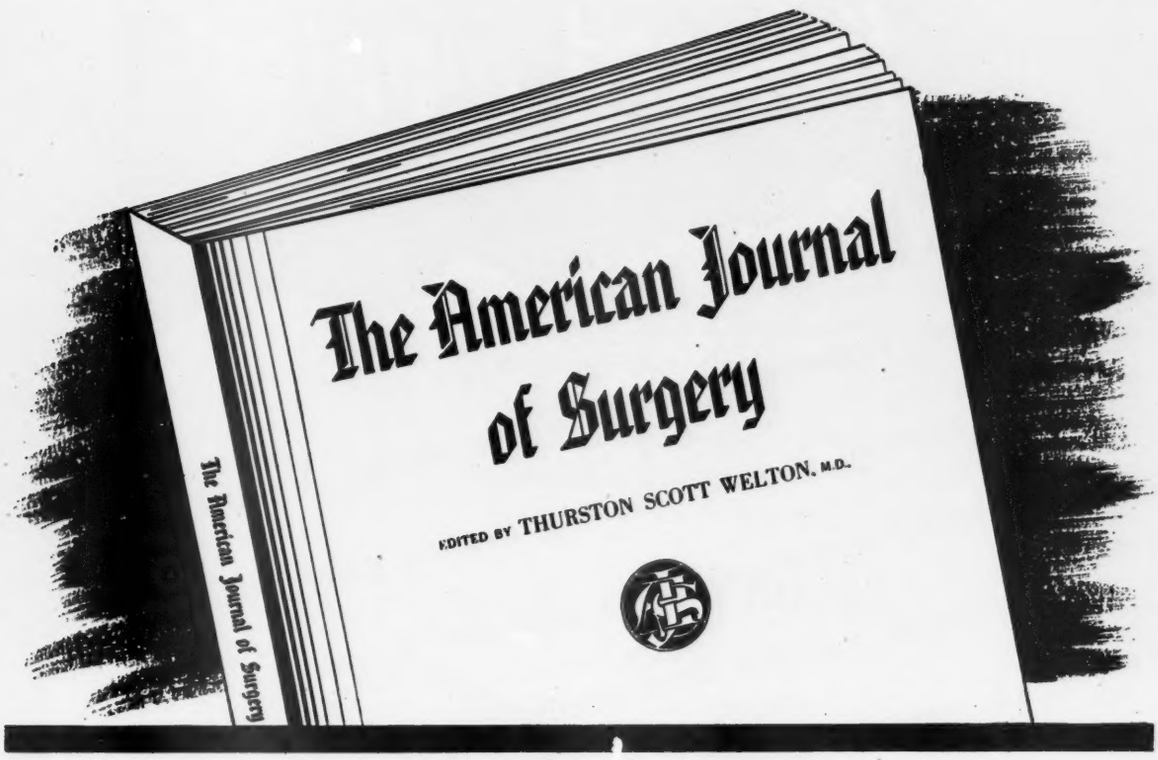
SECOND—**used before washing, TRUSHAY enables you to examine and treat patients with hands that are not only soft and smooth but hygienically clean.**

Try TRUSHAY today. A bottle lasts a surprisingly long time.

TRUSHAY

THE "BEFOREHAND" LOTION

***A Product of* BRISTOL-MYERS COMPANY**
19 NF West 50th Street, New York 20, N. Y.



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- "Preliminary evaluation of a vitamin A and D ointment in preventing and treating painful and tender postpartum nipples, with and without gross fissures, indicates that results with the vitamin ointment are far better than with other previously used methods and medicaments."

* Brougher, John C.: West
52:520-521 (Dec.) 1944

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Prophylactic doses of AMPHOJEL minimize the danger of postoperative jejunal ulcer. Amphojel buffers gastric acid, precipitates pepsin and forms a protective coating over the mucosa. Amphojel Plain, Amphojel with Mineral Oil, Amphojel without Flavor are supplied in bottles of 12 fl. oz. Amphojel Tablets are supplied in boxes of 60. DOSE: 1 or 2 teaspoonfuls (½-1 tablet) five or six times a day, between feedings.

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The American Journal of Surgery

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